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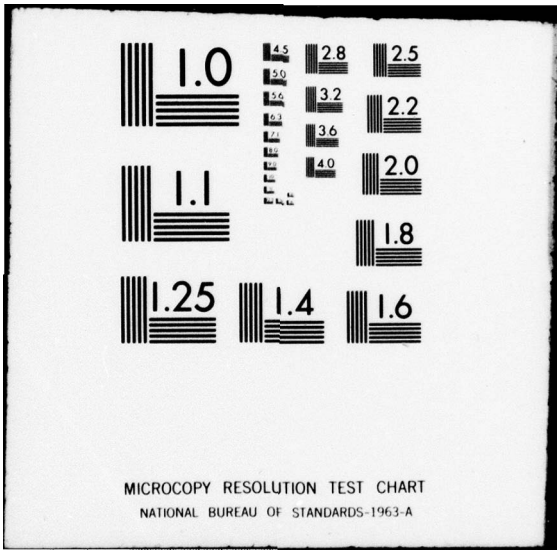
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

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OF A NAVAL SHIPYARD

by

Mahmoud Mazaheri

December 1978

Thesis Advisor: D. N. Burt

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Planning Concepts for Activation of a Naval Shipyard

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

All too frequently, large industrial projects are designed and constructed without sufficient attention being paid to the resources required to operate the completed facilities. This thesis addresses some of the many issues associated with activating such an industrial complex--a conceptual naval shipyard.

The planning, scheduling, coordination and control required to manage the activation of a shipyard together with the concepts of logistics support, project management and Management Information Systems (M.I.S.)are described. The inter-relationship of many government agencies/departments are discussed and some of the major activation tasks are identified. A multi-matrix organization structure along with its Matrix Authority-Responsibility Chart (MARC) are recommended to manage the activation program. Personnel and training is identified as the most critical task for this major program. The crucial task of manpower planning is analyzed. A manpower recruitment model, and other issues to be considered for the special environment of the shipyard are also presented. The research concludes with an overall summary and recommendations for establishing a program office and the early start of the training program.

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I. INTRODUCTION

A. GENERAL

Often due to the complexity of a project or by the reality of day-to-day job pressures, the managers concentrate on the present, ignore the past and let tomorrow take care of itself. Managers who are taken in by this approach, however, are not exercising their leadership to its fullest potential. Behaviorally and psychologically, management should be oriented toward the future; carving time out of the present for the service of tomorrow [1:267].[1] Some managers tend to neglect planning because they are too busy in the present striving for immediate rewards or avoiding punishments.

Major projects represent an extensive capital investment in material and human effort. Experience indicates that, even with "good" planning, major cost over-runs and considerable delays of these projects are not uncommon. An even more embarrassing and less excusable occurrence on such projects is the inability to fully utilize the facilities upon their completion.

This all too common phenomenon is not solely due to lack of technical knowledge or the irresponsible attitude of the individual. In fact, the author contends that it is more often the result of:

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[1] [1:267] denotes reference 1, page 267.

1. Over-anxiousness or pre-occupation with one part of the complex project, (e.g., the design or construction of the facilities).

2. Lack of understanding of the complexity of the project and its interrelationship with other activities.

3. Non-routine or uniqueness of the situation.

4. Lack of insight into long range planning and inability to coordinate numerous tasks over different time horizons.

5. The responsible individual not having control over all cognizant activities.

6. Lack of mutual understanding due to: communication/language barriers and technological gaps between: (a) different levels of organization (i.e., superior and subordinate); (b) different organizational segments (agencies/departments of the same organization) and (c) different societies (i.e., developed countries and developing nations).

Some of the causes of these shortcomings are the lack of skilled operating personnel, support utilities, amenities and material support. Thus it is of great importance to all concerned in a major program to look ahead and plan from the very <u>inception</u> of the program for its activation subsequent to the completion of physical construction. It is not surprising to see that for large-scale programs a program office is established. This office has the "total picture" and is responsible for the long-range planning, overall control, coordination, and activation of that program.

Planning for the activation of any new operation is challenging and demanding. It becomes even more of a challenge and more (if possible) critical when the location is remote, no skilled pool of labor exists and climatic conditions are inhospitable.

B. PURPOSE

The purpose of this research is to identify some of the key elements involved in planning for activating a conceptual naval shipyard in a remote and isolated area. In this unique situation, understanding the complexity of the problem, resource requirements (human and materials), the constraints (budget, time, environment, etc.) and coordination of activities is of great importance.

Long range planning is the key factor for the success of any complex and multifaceted project, requiring a systematic method of anticipating future conditions and coordinating the employment of resources in a manner which enhances achievements of established goals and objectives. The objective is "the operational readiness of the shipyard" by a certain time. To reach this objective major decision points must be achieved all along the process for activation of the shipyard.

The intent is to explain briefly the facets of long-range planning, integrated logistic support, program management and control techniques employed to satisfy the goal of successful activation of the shipyard.

Heavy emphasis is placed on planning for recruitment and training of personnel and coordination of major activities for successful management of this program. Certain observations and recommendations are presented that may be helpful to: the commander and executives for strategic planning, the managers for timely planning and the project team for overall control and coordination of the program.

The author emphasizes that this thesis is not a planning document and it certainly is not a comprehensive guide for the activation process. If this study does nothing more than to plant these ideas (awareness and understanding) that there is a pressing need for adequate planning; integrated logistic support and proper management of such a complex program, it will have served its purpose.

Due to the sensitivity of the classified materials, this report should be considered as a conceptual approach to the tasks which should be performed.

C. ASSUMPTIONS

To be able to undertake a problem of such magnitude as "planning for activation of a naval shipyard" the following aggregate assumptions are made:

1. The shipyard will start its limited operation with a complement of about 500 "civilian" technical personnel. The personnel will build-up to a complement of about 5,000 men in a period of 9 years, and will then remain constant.

2. The shipyard organization, structure and management procedures will be similar to those at a United States Naval Shipyard in accordance with the Standard Naval Shipyard Organization Manual.

3. The location of the shipyard may be assumed to be along the Persian Gulf or Oman Sea Coast at a newly established naval base. This port is at least 1,500 miles away from the nearest major city.

4. The construction of major land routes and railways to the port may start so as to coincide with the activation of the naval shipyard. Hence the best access is by air or sea routes, depending on the type of cargo and availability or time.

5. There are no local civilian or military support facilities. The normal community support services will be concurrently developed by commercial interests.

6. The naval base will function as a host for the shipyard and will develop support facilities (police, fire, medical, legal, safety, food service, housing, recreation, etc.) on a time schedule to coincide with completion of shipyard construction. Note: While the importance of such support facilities cannot be overemphasized, they are discussed in this thesis only as they influence the organization of the proposed program office.

It is recognized that while normal construction period for a shipyard complex may take ten years from the design and development to completion, the time required for the

recruitment, training and gaining of experience of a well qualified personnel force may be even greater.

In order to better understand the complex process of planning required to activate a shipyard, it is desirable to be familiar with the nature of naval shipyards. This will be the subject of the next chapter.

II. NAVAL SHIPYARD: BACKGROUND

A naval shipyard is an industrial organization of which the upper management[2] level traditionally is comprised of a steep hierarchy of executive and technical experts. The lower division is a broad mass of technical personnel (mechanics and journeymen; apprentices, and helpers) usually classified as skilled, semi-skilled and unskilled. The middle management in the "foreman" role is the subsidiary link between the upper and lower division. In regards to the operational structure of the Navy, Arthur K. Davis[3] states that in terms of occupational functions, the Navy corresponds to the general occupational pattern of modern industrial economics [2:382]. A naval shipyard, being a homogeneous subset of the whole navy organization, cannot be an exception to the Navy's organizational structure. There are centuries of experience on the structure and functions of naval shipyards in Europe and many other parts of the world. But to develop and start-up a naval shipyard in the Persian Gulf area requires a good understanding of the environmental conditions; the shipyard structure and authority;

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[2]Most common positions are: The Commander or Superintendents, managers or heads of departments for a naval shipyard. The terms President/Chairman, directors and managers are used in civilian shipyards.

[3]Author of the article "Bureaucratic Patterns in the Navy Officer Corps". See reference 2, p. 382.

and the culture of the region. Hence this chapter will briefly describe the environment, general location and climatic conditions. It also discusses the nature and overall structure of United States naval shipyards. Finally, some views on the need for a bureaucratic organization in a shipyard, and the awareness of the culture for the country or the region under consideration will be presented. Understanding the nature of this industrial complex is vital to the operators and the users alike. It uncovers the types of problems one would normally face in a navy yard and it should also assist in the selection of better management techniques for the accomplishment of the assigned mission.

A. GENERAL ENVIRONMENT

The environment generally consists of the physical (i.e., location and climatic) and the social or cultural traditions. Every organization has great influence on its environment, as well as being influenced by the environment. As organizations become larger, the interaction between the environment and the organization becomes more significant; and, in fact, the organization and environment begin to affect and modify each other. For example, it is important to be aware that due to excessive heat during the summer season (June - August), workmen slow down and productivity drops considerably. Working in open-air in a midsummer day is a drudgery and sometimes unpleasant. Hence the working hours are often changed in the summer season. People start work very early in the morning and later in the afternoon. Some natives from the region

leave the area during the hot season. After the hot season they may come back again if there are sufficient incentives.

To build a naval shipyard in a remote location along the Oman Sea or the Persian Gulf coast will be a mammoth industrial undertaking. Adequate logistics support will be an important factor in the successful and timely completion of the program. Equally important are the logistics support requirements for the operation of the completed facilities. Considering the locality and the environmental conditions (which are described in the following paragraph) the importance of planning for the development of adequate skilled manpower and the related support facilities cannot be overemphasized.

1. Location and Facilities

The location of the naval shipyard is assumed to be somewhere along the Persian Gulf and Oman Sea Coast. The shipyard is part of a naval base complex assumed to be situated approximately 1500 miles away from the nearest major city.[4] There is no adequate overland travel network to this port at the present time. Provision of this important requirement would require construction of more than 1,000 miles of roads and/or railroads. It is further assumed that there is an airport in existence which could be expanded. There is a natural harbor, suitable for a new port facility, which

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[4]The location is imaginary and distances are not real. They are picked purely for the sake of this thesis.

will be available to accomodate the major equipment required to construct the shipyard.

The total program should consist of the construction of a breakwater system to enclose an area to be developed as a naval harbor and to accomodate the construction necessary for the installation of a naval base complex with berthing piers, dry docks, the shipyard, supply and other logistic facilities for the assigned ships. It is also assumed that extensive shore facilities will be constructed by different contractors on the land adjacent to the naval harbor. These shore facilities will include housing, recreation, supply facilities, offices, communication and other community facilities which are required to support the personnel and operations within the naval base.

It is recognized that for this remote naval base every needed resource (labor, material, etc.) has to be imported. Non-skilled labor will be supplied from country sources. It is assumed that there will be a shortage of semi-skilled labor and the skilled craftsmen will have to be totally trained or contracted-for from other countries for near term requirements.

2. Climatic Conditions

The weather conditions that follow are typical of those prevalent along the Persian Gulf and Oman Sea. Average daily temperatures vary from a mean maximum of 51°F (10.6°C) in winter to a mean maximum of 102°F (38.9°C) in the summer with an average year-round temperature of 75-80°F(23.9-26.7°C).

The absolute range of temperature is approximately from 120°F (48.9°C) in summer to 32°F (0°C) in winter, the highest values occurring between the months of June and August. Relative humidity is high most of the year and varies between 50 and 98%, with an average maximum of about 76 percent; most humid conditions occurring in the early morning and during calm weather conditions. During the summer and autumn months the relative humidity ranges from an average of 62% to 71 percent. Average annual precipitation ranges from near 4 to 12 inches along the coast with the heaviest rainfall occurring in late winter [3:0082].

3. Social Environment

Countries along the Persian Gulf have their own individual social habit, culture, and religious beliefs. These are somewhat different from one another and from those in the western world. Iran is situated on the entire northern coast of the Persian Gulf and has its own very rich culture, and over 2,500 years of recorded history. Its people are very proud of its culture and history. The religion of the overwhelming majority of the inhabitants is Islam. They strongly believe in and practice their daily prayers. It is, therefore, important to realize and respect the local habit and the social norm. One not only should be aware and allow for prayer time during the day, but also make certain that there is a respectable place (mosque or other suitable prayer-room) available.

The social environment also consists of the relationship with the local community, higher authorities, labor unions, other government and industrial organizations; the last and the most important one of all being the customers (the ships of the fleet). The relationship with the fleet are especially important because the proper maintenance of the fleet is the only reason for the existence of a naval shipyard. Social environment will further affect the shipyard in the form of: fluctuating workloads, changes of labor force, the economy of the community, recession and inflation periods, and the general economy of the country. It is, therefore, essential to be in-tough and to keep-up with the "trend of the time".

B. NAVAL SHIPYARD

In this section the growth, the history and the nature of a naval shipyard will be described briefly. The shipyard command and coordination, organizational hierarchy, mission, and operation of naval shipyard are discussed. The shipyard work force structure and its fluctuations, and the utilization of dry docks are also presented.

1. Brief History

Traditionally in the British Navy, "royal dockyards" were along craft union lines, such as engineering, electrical, construction departments, etc. under a single manager called "superintendent" as shown in Figure 1 below:

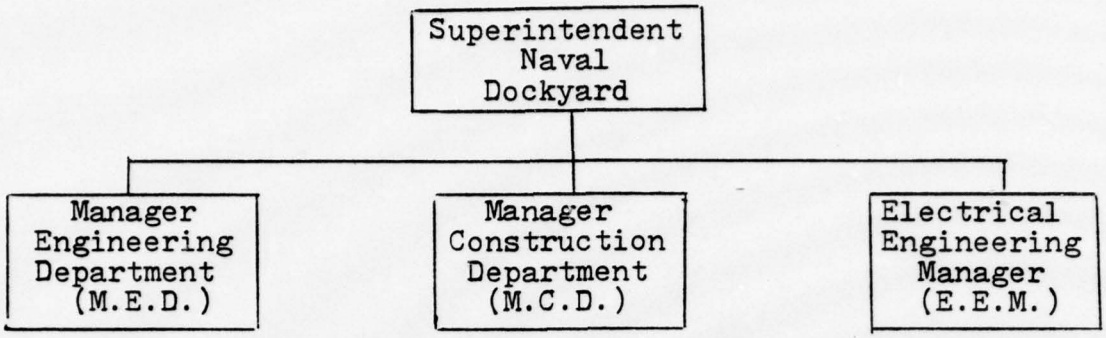

Figure 1. Naval dockyard organization pattern.

In England and some other countries the term "dockyard" signifies a military establishment for the repair, overhaul, conversion and construction of naval vessels.

Naval shipyards in the United States of America started in the year 1799 with authorization of the Congress to build four shipyards in Portsmouth, Boston, Philadelphia, and Norfolk. Mare Island and Puget Sound Naval shipyards were authorized in the years 1852 and 1891 respectively. The last four naval shipyards authorized were: Charleston in 1901, Pearl Harbor in 1908, Hunters Point in 1939 and Long Beach in 1940 [4:26]. From the earliest years through World War I, the naval shipyards were the principal logistic support element in the Navy shore establishment. As such, they were developed to provide a range of services over and above those of a purely industrial nature. These services included supply and dental care for seagoing personnel and provision of training and recreational facilities.

During World War II expansion, additional activities were established to supplement the naval shipyards support

functions. Two of the naval shipyards, Bostom and Hunters Point were subsequently closed during the Navy force reduction in 1973.

The maximum employment in all of the United States Naval Shipyards at any one time was about 353,000 in July 1943 and has fluctuated considerably to the present estimated number of approximately 69,000.

The United States Navy presently operates eight naval shipyards.[5] These shipyards are engaged only in conversion, repair and overhaul of Navy ships and have not been involved in any new construction since 1967. Only three Navy shipyards (Philadelphia, Mare Island and Puget Sound) now have the capability for new construction. "It has been a stated policy of the United States Navy that it does not intend to shift its shipbuilding from private to Navy yards except as a backup in the event private shipbuilders become saturated with commercial work" [5:60].

Since 1974, the Navy has been directed by the Congress to allocate 30% of its ship overhaul/repair/alterations work to private shipyards. This percentage is expected to remain a minimum requirement and could increase if more pressure is applied by the shipbuilding industry on Congress.

2. The Nature of a Naval Shipyard

A naval shipyard is an integrated industrial plant with a full range of shop facilities and a full range of

---

[5]See Appendix A, presenting total employees and other specifications for each of United States Naval Shipyards as of March 1970.

engineering design and shop personnel skills in keeping with the mission. Thus every naval shipyard has a shipfitters shop, sheet metal shop, welding shop, inside and outside machine shop, electrical and electronics shop, paint shop, a rigger shop, and service and tool shop [4:26]. In every case, the naval shipyards have ordinances and fire control shop capabilities adequate for the ship types they serve.

Each naval shipyard has a permanent staff of craftsmen capable of performing any type of work that may be required by the ships served. In addition, each of the naval shipyards has a qualified design and engineering staff responsible for preparing the technical specifications for the work to be performed.

With these shops and skills, the naval shipyards have the in-house capability to successfully perform virtually any work assigned, including the manufacture of replacement parts if the parts cannot be obtained from the supply system or the original vendor. The scope of the facilities and capabilities just mentioned is influenced by the kinds of work and types of ships assigned.

In the following paragraphs, the principal requirements for the structural and functional authority of naval shipyards are briefly described.

a. Shipyard Command and Coordination

In the United States Navy the superintendent of a naval shipyard is called "the shipyard commander". He is subordinate to the Commander of Naval Sea Systems Command.

He is a naval officer ordered by the United States Bureau of Naval Personnel, upon the recommendation of the Naval Sea Systems Command, to command the assigned shipyard. The shipyard commander is under the area coordination of a particular naval base/district commander assigned by the Chief of Naval Operations. In addition to the direction and support provided by the Naval Sea Systems Command; other commands, bureaus and offices within United States Naval organization provide administrative and technical guidance in accordance with their assigned functional authority and responsibility [6:i]. Appendix B, Charts 1 and 2 show organizational relationships between the shipyard commander and other external authorities.

b. Organizational Hierarchy

During earlier years, naval shipyards operated with a very loose type of organization. Each bureau had its own senior representative in the yard with its own shops and it furnished the funds necessary to operate these shops. It took many years until the first naval industrial organization was established with an overall manager who was responsible for the total operation of the shipyard. There also was the military commander, to whom the industrial manager was responsible for the building, conversion and repair operations of the shops.

Considerable progress was made when naval shipyards were brought under a centralized management system. Nowadays, the organization and general administration of United States

Naval Shipyards are in accordance with United States Navy Regulations, with applicable Department of the Navy directives and the structural and functional organization charts contained in the Standard Naval Shipyard Organization Manual [6:iii].

A modified organization chart showing some of the departments and offices under the shipyard commander is depicted in Figure 2:

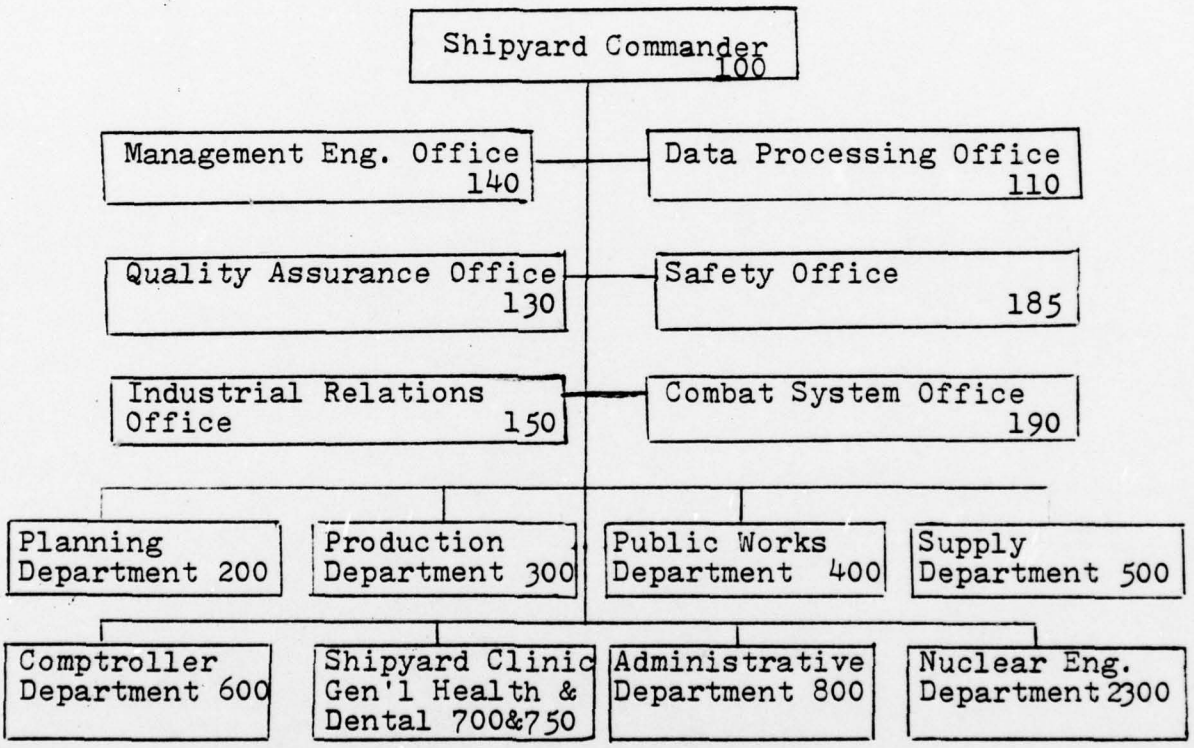

Figure 2. Shipyard organization structure.

For the responsibilities of the shipyard commander and the heads of departments see reference 6.

c. Mission of a Shipyard

The official mission assigned to naval shipyards is:

> "To provide logistic support for assigned ships and service craft; to perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned; and to provide services and material to other activities and units, as directed by competent authority" [6:i].

d. Shipyard Operation

As was briefly described above, the shipyards in the United States Navy are coordinated industrial organizations which are standardized in their format throughout all naval shipyards. The operation of a naval shipyard is similar to a commercial organization in many respects. The shipyard commander is responsible to the Naval Sea Systems Command the same way as the president of a company is responsible to the board of directors. In regards to the financial matters, while the commercial organizations are profit-oriented and desire to show a reasonable profit at the end of a year, the naval shipyard looks for a "break-even" point (i.e., no profit and no loss).

3. Shipyard Work Force

Mission accomplishment is largely dependent on the personnel assigned to get the work done. The size and composition by trade of the work force in naval shipyards varies with the requirements of the work. Military and

civilian personnel complement each other in providing an effective team for fleet industrial support.

In a United States shipyard there is roughly one naval officer to every 110 civilian employees. The preponderances are engineering duty and unrestricted line officers; and, of course, there are supply, civil engineering and other officers as well. The use of military rather than civilian personnel in certain positions is based on a specific determination of one or more of the following criteria:

(a) The position has strong elements of military responsibility and accountability.

(b) It requires a military background to facilitate understanding the viewpoint of the forces afloat.

(c) The position provides training and experience required for career development of the military personnel.

(d) It supports sea-shore rotation providing appropriate duties for the military personnel involved.

In the United States, approximately 66 percent of total shipyard employees are engaged in the production area. Of the total production department work force, approximately 27 percent are normally available as indirect labor and about 61 percent as direct labor on any given day. (The remaining 12 percent workers are projected daily absentees.) Table I shows comparative figures for the Mare Island Naval Shipyard in mid 1976 (7:16).

TABLE I. Work force composition - Mare Island Naval Shipyard (Sept. 1976)

Description	Work Force	% Total Production Work Force
Total Production Dept. Work Force	6470	100
Direct Labor Force	3960	61
Indirect Labor Force	1750	27
Projected Daily Absentees	760	12
GRAND TOTAL EMPLOYMENT (September 1976)	9800	

The civilian work force is heavily weighted with skilled journeymen in some 80 to 100 occupations. A continous effort is expended to develop these skills. There is an extensive apprentice training program which involves more than 6.4% of the total civilian personnel. There is also a great amount of training conducted to provide both engineers and mechanics knowledge in new systems and equipments. And, of course, continuing efforts are made to improve supervisory and other administrative and managerial capabilities. Table II shows the numbers and categories of civilian personnel in all United States Naval Shipyards as of March 31, 1970 [4:27].

TABLE II. Numbers and categories of civilian personnel in all United States Naval Shipyards as of March 31, 1970.

BLUE COLOR EMPLOYEES	NUMBERS	PERCENT TOTAL
Supervisors	5,218	6.30
Journeymen	45,755	54.80
Limited Mechanics	2,163	2.60
Apprentices	5,373	6.40
Helpers	3,579	4.30
Laborers	1,237	1.50
TOTAL	63,325	75.90
WHITE COLLAR EMPLOYEES		
Engineers and Designers	3,515	4.20
Supply, Accounting, etc.	16,606	19.90
TOTAL	20,121	24.10
GRAND TOTAL	83,446	100%

4. Work Force Fluctuation

Today's complex ships with their larger work packages create substantial peak manpower workloads during their overhauls. However, these loads neither occur during the same period of time nor are of the same magnitude for each of the trades. The result is that the demand on each specific trade fluctuates rather widely. The ideal solution is to assign sufficient work, properly scheduled, so that the various skilled craftsmen can move effectively from ship to ship. Since this is not always possible, shift work, overtime assignment, forced leave, loans of manpower, working men in secondary skills and other devices are necessary management actions to balance manpower against workload [4:30].

5. Dry Dock Utilization

A "dry-dock" is a basin of water which can be closed off by a gate. The ship is floated in, the gate is closed and the water pumped out to allow for the cleaning, repair and maintenance of the ship's underwater structure.

Modern ships of the Navy are usually larger and deeper than the older ships they replace. They are more complex and more work is required during overhaul and the period in dry dock; thus longer periods of dry dock time are required. The result has been an increase in large dry dock utilization and the trend is still continuing upward. Accordingly, dry docks are one of the most important facilities considerations with respect to shipyard overhaul capacity.

C. BUREAUCRACY AND CULTURE

Naval shipyards normally cover a large area and employ several thousands of men at any given time. This size alone would impose the bureaucratic pattern on naval shipyards' organization. Coordination of masses of men and material clearly requires the employment of those properties of precision, impersonality, and reliability which make bureaucracy the most efficient form of large-scale organization.

> To most people bureaucracy is a dirty word. It suggests rigid rules and regulations, a hierarchy of offices, narrow specialization of personnel, red tape, irresponsibility, an abundance of offices or units which can hamstring those who want to get things done, impersonality and resistance to change. Yet every organization of any significant size is bureaucratized

> to some degree or, to put it differently, exhibits more or less stable patterns of behavior based upon a structure of roles and specialized tasks. Bureaucracy, in this sense, is another word for structure [8:50].

A naval shipyard is an integrated hierarchy of specialized talents and shops defined by systematic rules--an impersonal routinized structure wherein legitimized authority rests in the office and not in the person of the incumbent [2:383].

For the social scientist, bureaucracy is a form of rational (goal-directed) social (cooperative) action in which behavior patterns are designed to achieve the highest goals <u>for those who establish and maintain the bureaucracy</u>. The chain of command clarifies and defines goals, determines the means for carrying out those goals, divides the task of achieving goals into smaller parts or roles to be expected by separate specialized units, coordinates the activities of those units, and ensures that all efforts are directed toward accomplishing the bureaucracy's goals [9:30].

Bureaucracy is the prevalent method of organization in the world today because this form of organization is efficient in carrying out the goals of public policy and of private profit oriented entities. With bureaucratic organizations, the talents and energies of masses of people can be mobilized to accomplish otherwise impossible collective goals. With such an understanding, it is necessary to see how the bureaucratic form of organization will be influenced by different cultures.

"<u>Culture</u>" is a word that has many meanings. Culture has long stood for the way of life of a people, for the sum of

their learned behavior patterns, attitudes, and material things [10:43].

H. T. Hall states that "Culture is more than mere custom that can be shed or changed like a suit of clothes." He further believes that: Americans think of "under-developed countries as being backward and stubborn," or "thought to be led by grasping leaders who have no concern for their peoples welfare." Unfortunately some of these statements may be true. They can also be a convenient excuse for United States' failures aboard on the technical assistance, military aid, and diplomatic fronts. "But most of our (the United States') difficulties stem from our own ignorance" [10:48]. One must understand the culture, tradition, habits, and way of life of other peoples. Admiral Hayward recently most appropriately stated that there is great value in understanding the history, culture and tradition of others. These values must be respected in their own way. We must be well aware and cautious about how fast they can change [11].

Most men in the field continue to fail to grasp the true significance of the fact that culture controls behavior in deep and persisting ways, many of which are outside of awareness and therefore beyond conscious control of the individual. Culture hides much more than it reveals and, strangely enough, what it hides, it hides most effectively from its own participants. Much research has proved that the real job is not to understand foreign culture, but to understand one's own culture. All that one ever gets from studying foreign culture

is a token understanding. The ultimate reason for such study is to learn more about how one's own system works. The best reason for exposing oneself to foreign ways is to generate a sense of vitality and awareness - an interest in life which can come only when one lives through the shock of contrast and difference [10:53].

As it was described, "bureaucracy" like any other system has its many advantages. It also has its limitations and disadvantages. The bureaucratic organizational system can be misused or over-done; in which case favoritism and corruption will certainly pervail. It should be realized that one organization's goals cannot be perfect for others. In fact, the goals of different organizations can often be very different and contradictory. The differences are much more important when different cultures are considered. Therefore, the bureaucracy created in one country cannot be applied blindly to some other country. The historical background and social differences of each country must be considered.

Any form of bureaucracy should grow with the particular culture and through the transformation process. Hence bureaucracy must be adapted with care and full understanding. Awareness of one's own culture; recognition of historical background and social differences between different nationals are of great importance in the development of a bureaucracy.

D. ORGANIZATION CONSIDERATIONS

The question here is: What should be the organizational structure for an Imperial Iranian Naval (I.I.N.) Shipyard?

In Section "B" of this Chapter, the nature and trend of the bureaucratic character of a United States Naval Shipyard was discussed. This should not give one the idea that this is the type of organization proposed for an Iranian Naval Shipyard. There is no single best pattern of organization that can serve all nations or all industrial organizations within a nation. The organizational structure that has evolved through the years and serves the United States Navy well may not work satisfactorily for other navies. The mission of the particular shipyard; the size (work force); the physical and social environments; the kinds and complexity of tasks assigned; labor-management history and current relations; the type of ships to be maintained and overhauled; the social norms, culture and skills of the operating personnel will have a great influence on the choice of an organization pattern. Even for organizations in the same environment, the period during which a new organization is implemented plays an important role. On the other hand it would be a waste of time and resources to try to "reinvent the wheel". It would be ineffective and expensive for non-industrial nations not to benefit from the experience of more industrialized countries. The organizational structure for a newly established naval shipyard in the extremely fast expanding navy of Iran, should evolve. The structure of such an organization cannot be static. It should be modified and expanded through a steady and stable progression; but it must, at the same time, provide for a dynamic growth pattern.

For the rapidly developing countries such as Iran a more rapid developmental pace is appropriate. We live in a rapidly expanding technological age. During the last generation, innumerable new systems, and many organizational formats have been developed. The successful integration and utilization of these systems/organizations has been the masterpiece of modern technology in itself. Transfer of this new technology is the only way to bridge the gap between the modern technological know-how and traditional or indigenous technology. Hence, adaptation of new techology and transformation of skills is essential. The modern ships of today's navies have complex and sophisticated systems. They require highly skilled men who are up-to-date in the current, but ever-changing technology. They also require an efficient organizational structure in which to operate. To effectively integrate and properly utilize the talents of men and the capabilities (output) of machines is the greatest challenge to management.

For a conceptual Iranian Naval Shipyard organization (growing to a 5,000 man work force), a bureaucratic structure (as described in the previous section) is inevitable:

(1) Bureaucracy is created in a naval shipyard because of the efficiencies in the bureaucratic form of social organization. Some kinds of tasks seem to be most efficiently performed by organizations with a chain of command, specializations, impersonality, and rules.

(2) Bureaucracy has been found extremely useful in dealing with tasks of great size, complexity and technicality.

(3) Bureaucracy is everywhere in varying degrees. It is especially evident in a large-scale industrial organization such as a shipyard. It is here and we cannot avoid it, but we must learn how to live with it, use it properly and make it work for us.

Bureaucracy is not a disease, but it certainly spreads like one. It has the symptoms of highly contagious disease which spreads rapidly and may kill the unprepared, uneducated and innocent victim. It is the outcome of modern technology and the off-spring of a growing organization. However, extra caution and special consideration should be given to any newly established and rapidly growing organization.

Roger Harris states that the start-up organization has to process a great deal more information than the normal "steady state" organization. There are four basic ways of dealing with the needs of a new organization:

(1) Provide more of everything: people, money, and time during the start-up period. (Turnovers will usually exceed estimates.)

(2) Break the organization up into self-contained parts which are as independent of one another as possible.

(3) Establish sophisticated sensing, planning, and problem solving and progress tracking systems.

(4) Create project teams, task forces, and other lateral communication and decision making links, so that problems can be dealt with at lower levels in the organization [12:1].

For a newly established organization, the most effective role for higher management is that of support, strategy and protection. Higher authority's role of support is in the form of needed resources; strategy in the way of indicating structure and manning of key positions, as well as broader financial status; and protection is in the manner of creating an "umbrella" which shields those who are operating the new shipyard from outside pressures and interference [12:1]. With these considerations in mind, the adaptation of the organizational structure of a United States Naval Shipyard, as presented in Section B, Figure 2, would require suitable modification for an Iranian Shipyard. This could be of the format as shown in Figure 3.

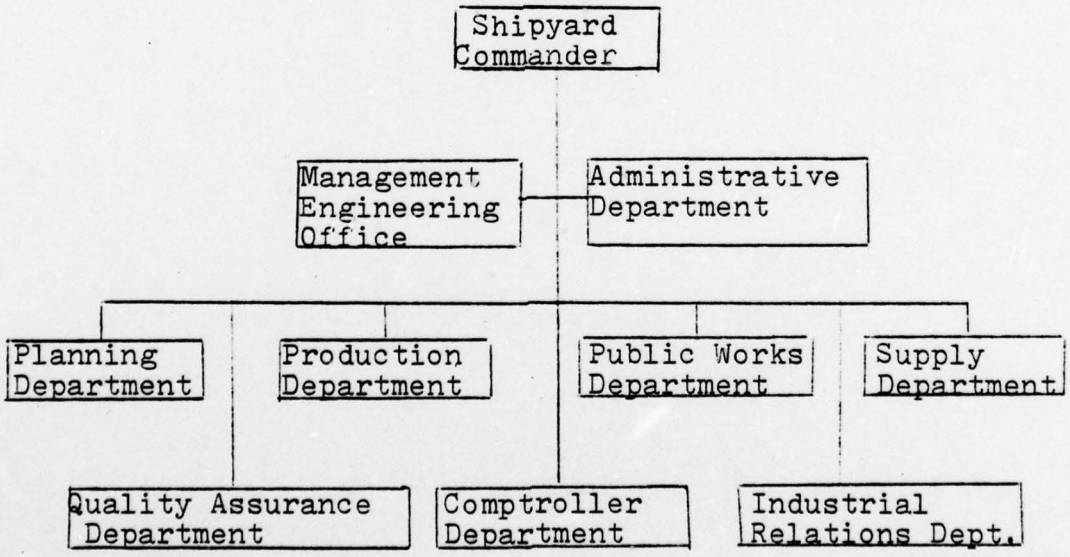

Figure 3. Modified organizational pattern.

Comparing Figure 2 and Figure 3 above will indicate the following changes:

(1) The data processing office can be amalgamated and made a part of the comptroller department.

(2) The safety office and shipyard clinics may be made a part of the industrial relations office.

(3) The combat systems office could be made an integral part of the production department.

(4) The nuclear engineering department must be eliminated since there are no nuclear propulsion vessels in the Imperial Iranian Navy.

Having defined the objectives of this research and having provided background on Naval shipyards and the environment of our conceptual shipyard, it is appropriate to describe the research techniques used to compile this document. This is the subject of the next chapter.

III. RESEARCH METHODOLOGY

About January 1978 the subject of "activation of a naval shipyard", still vague in the mind of the author, was for the first time discussed with the prospective thesis advisor. The advisor elaborated on the planning aspect of the subject and pointed out that the research could have far reaching practical application to the successful activation of such a complex activity.

After more discussion with other professors and further refinement of the topic the following research methodology was adopted.

A. LITERATURE SEARCH

There is a large amount of literature and many research studies available for every chapter and section of this thesis. The author's continuous battle has been to contain such a broad subject to a manageable size in the time period available. The "planning concepts for activation of a naval shipyard" in an isolated place, with a hostile climatic environment is a unique task by itself. However a search and review of topics on long range planning; project management, planning, scheduling, organization and staffing, control and coordination, and project network (PERT/CPM) were carried out. Proper logistic support is a prime consideration for the success of any system, and its importance

is further emphasized for the particular environment of the conceptual project. Hence a study of Integrated Logistics System (I.L.S.) began. The elements of I.L.S.: personnel and training, facilities, supply support, transportation and handling, test and support equipment, technical data, were identified.

B. VISITS AND INTERVIEWS

Personnel with extensive background in the subject and those with previous experience in the Persian Gulf environment were the target of this effort. After some study, plans were made to visit some of the individuals who had experience in this field and some of the facilities of a similar function. Noted officials were interviewed during the visits and considerable insight was gained from their views and experiences. More than 100 persons who had experience and background on the related subjects of: planning, logistics, personnel and training, shipyards, organization development, the Persian Gulf, Iran and other developing countries were interviewed. Those individuals and locations visited are:

The Chief Imperial Iranian mission to the United States of America, Arlington, Virginia;

Director of Facilities and Equipment Division, Naval Sea Systems Command, Washington, D.C.;

Manager of Division Construction, Bechtel Corporation, Engineers-Contractors, San Francisco, California;

Director, Special Projects, Kaiser Engineers, Oakland, California;

The Shipyard Commander, Training Division and Management Engineering Office, Philadelphia Naval Shipyard, Philadelphia, Pennsylvania;

Project Manager, Diego Garcia Construction Project Office, Alexandria, Virginia;

Director of Subbase Acquisition, Trident Program Office, N.C.3 , Crystal City, Virginia;

Group Vice President, Project Office Staff, Brown and Root, Inc., Houston, Texas;

Manager, International Training Group, Personnel Training and Development, Brown and Root, Inc., Houston, Texas;

Vice President, Programs Management; Litton, Ingalls Shipbuilding, Pascagoula, Mississippi;

Operations Research and Administrative Science Department Chairmen, noted Professors; Heads of Departments; United States Naval Postgraduate School, Monterey, California;

United States Naval Officers with previous experience in similar projects or tours of duty in the Persian Gulf area;

Iranian Project Liaison Officer, N.C. 3, Crystal City, Virginia;

Iranian Supply Officer, and Project Liaison Officer, Philadelphia, Pennsylvania;

Ex-military officers and businessmen who served overseas or had experiences in the Persian Gulf region;

Finally many United States and allied student friends, with interest in this subject.

Some of the views and comments made during these interviews are included throughout this thesis. These examples provide further insight into the diversity of the subject and the different problems experienced and emphasis given to different aspects of the same problem by different men in different positions.

C. STUDY OF SIMILAR PROJECTS

Further, a search was carried out through the inter-library computer service and also the Defense Logistics Studies Information Exchange (DLSIE). Documentation on previous base development management, planning for logistic support efforts in the Vietnam Era and also Transition plans for on-going projects such as Diego-Garcia Development and Trident Base acquistion were obtained and studied.

D. PERSONAL EXPERIENCE

Personal experience both in the Persian Gulf and overseas has given the author much insight and motivation as to the identification of problems and the importance of this task. He has had more than 21 years of service experience of which more than ten years has been spent in responsible positions in the ships and industrial organization/technical establishments in the Persian Gulf area. He has traveled and lived in that region, been exposed to the environment and certainly feels the importance of integrated logistics support and planning for activation of an industrial activity as complex as a shipyard. He has spent about eight years in England, and more than four years in the United States of America, mostly in the training establishments and the naval shipyards. The author has traveled extensively during this period visiting many industrial centers, military establishments and more than twelve shipyards throughout Europe, the United States of America, Turkey, Pakistan, India and Iran. He has been directly associated with or served in shipyards for more

than ten years of his service career. Many months of research and extensive interviews with many experts and specialists in this field has given the researcher great insight and reinforced his strong belief and own conviction of the need for a positive long-range planning on such a major undertaking with heavy emphasis on the personnel requirements and their appropriate training.

In Chapter IV the concepts of planning and logistics support will be discussed.

IV. PLANNING AND LOGISTIC SUPPORT

Part of the objective of this thesis is to point out the importance of timely planning and coordination as well as the necessity of integrated logistic support for any project. The author believes that this objective can be achieved only by understanding the principles, the need and the proper implementation of planning and logistic support concepts. The awareness and proper application of these management tools are of extreme importance in a complex project. The activation of a naval shipyard in a remote region and the hostile climatic environment of the Persian Gulf is certainly a project of such complexity.

Thirteen years ago, a similar project in a comparable environment, was in its design and development phase. It was planned to be completed in a period of five years. The construction was greatly delayed due to several reasons, including: a late start; lack of adequate integrated logistics support; inadequate planning and supervision; shortage of funds; and lack of control and coordination. The original construction cost estimate more than tripled due to the growth of work and inflation. As recently as two years ago (years after the target completion date) the project was nearing its physical completion. Just a few months months before that time it was realized that there were

shortages of skilled manpower, adequate electrical power, water, etc.

In addition, a large quantity of machinery, raw material and special equipment ordered to coincide with the much earlier planned completion date had been virtually idle for several years. Such experience shows that it is not uncommon for human beings to get overwhelmed by the day-to-day involvement of the organization, thus allowing other vital tasks to be overlooked. All too often we end up with warships, shipyards, planes and other systems that perform their missions only "after the expenditure of extraordinary effort - much of which could be avoided by better planning and foresight on the part of the government and industry" involved [13:6].

Therefore, in this chapter the concepts of planning, long-range plans and contingency plans will be discussed. In addition and in order to gain a better appreciation for the coordination required among activities and the life cycle cost for this project, the planning and coordination, logistic support, the system life-cycle, and logistic support management functions will be briefly described.

A. PLANNING CONCEPTS

> Planning, more than any other management technique, is misused, misunderstood, and more often times ignored. Yet its importance to successful operations and project management at all levels cannot be overstated. In fact, it has often been said the foundation for the success or failure of a project will be firmly established during the critical, initial proposal and planning phase [14:140].

Men have always been concerned about the future. They carry with them the fear of what is going to happen tomorrow. Ancient men took time out of his present to prepare physically and psychologically for his future. This ability, to draw upon past experience in the present to plan for the future, has been the biggest advantage of human beings over other species [1:267]. In the modern age, formal planning has grown in importance for many organizations because of increased technological complexity, financial risk, time lags, project size and substantial management decision burdons.

Long-range planning rests on dreams, strategies and a sense of what management would like the organization to become. These dreams and strategies will be a futile exercise unless they are converted into continuing objectives and specific goals with priorities for accomplishment. It is said that the purpose of planning is not to show precisely how we can predict the future, but rather to cover the things we must do today in order to have a future.

This section, on the broad subject of planning concepts, presents some of the definitions of planning; the need for planning, the nature of a plan, and the requirements for setting clearly defined goals. The hierarchy of planning, management and planning, and approach to planning are also discussed.

1. Definitions of Planning

George Steiner[6] defines planning as a process which begins with objectives; defines strategies, policies, and detailed plans to achieve them; establishes an organization to implement decisions and includes a review of performance and feed-back to introduce a new planning cycle. McFarland states that, "Planning is a pervasive and continuous process of anticipating, influencing, controlling and analyzing present conditions to make decisions for the future" [15:314].

In a laymen's term, planning may be defined as (1) thinking about what one wants and how he is going to accomplish it, (2) determining in advance what is to be done, (3) preparing for the future by making decisions now. Planning presents management's attempt to anticipate the future and guard itself against the threat of change. By its nature, planning is inherent in almost all management processes. However, it has no easily definable boundaries, no single right beginning, most certainly no end, and cannot be easily gathered up into a precise position or description for delegation to an individual or group. For the purposes of managing an industrial organization, the essence of planning is the identification of opportunities and threats, of whatever kind and wherever they exist, and the choosing among alternatives for allocations of resources of all kinds.

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[6]Professor George A. Steiner is the author of the book "Top Management Planning" and is considered by many to be the Dean of American long-range planners.

2. The Need for Planning

An increasing span of time, the growth lead time, the complexity and enormous expenses of large endeavors, all put heavy pressure on planners to achieve the central mission of minimizing uncertainty and its consequences. "The imperatives of modern technology have exercised a profound influence on the requirements for planning. Continuing, narrowing specialization has made tasks more complex and lengthy" [1:268]. The major benefit of planning may not be the plan itself, but rather the process which identifies the goals, strategies, resource requirements, and the interrelationships between decisions to be implemented. The key to planning is the determination of desires; and the critical aspect is knowing where one wants to be and how one wants the future to turn out.

The concepts of planning should not be a list of unrelated aspirations; the ideas should be integrated into a cohesive plan that has a threefold purpose. The first purpose is to provide a concept of what the organization ideally should be like as a whole. The second purpose is to provide a guide for planning systematically for transition of the existing organization into what is desired. Third, and the most important, planning may excite and fire the imagination of participating managers. In the following paragraphs the definitions of plans and the importance of goals are described:

a. What is a Plan?

We have already seen that a plan is a predetermined course of action. It represents organizational goals and the activities necessary to achieve the goals. Functional plans are those which outline intended action in a functional area such as personal and training, supply, facilities, finance, etc. Functional plans are a compilation of actions necessary to provide functional support necessary to the accomplishment of overall organizational planning goals. These plans are a combination of objectives, policies, procedures, budgets, and other elements necessary to achieve a predetermined specific objective.

b. Setting of goals

The goals of an organization represent, in effect, a series of constraints imposed on the organization by its participants. Goals and objectives are also defined as the appropriate response to recognized problems and opportunities. F. R. Kappel[7] states:

> "Unless the organization sets demanding and exciting goals, it runs a heavy risk of losing vitality. This is an area where people in top management positions have heavy responsibilities. If these goals fail to stimulate, there is something missing at the top" [16:91].

3. Hierarchy of Planning

A hierarchy of different levels of planning can be identified on the basis of the planning horizon for each

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[7]Quoted from reference 16 page 91.

level. Three levels frequently referred to in literature are strategic planning, tactical planning, and operational planning. Strategic planning deals with long-range considerations. The decision to be made relates to the future of the country as a whole, such as building a shipyard or the expansion of the navy.

Strategic planning calls for the greatest degree of imagination and reasoned intuitive judgement because it deals with an uncertain future and requires the allocation of resources when the results are not obvious.

Tactical planning is concerned with a medium-term planning horizon. It includes the ways resources should be acquired and organized. It is reflected in the capital expenditure budget; such as the navy training plan, the three-year staffing plan, etc.

Operational planning is related to short-term decisions for current operations, such as supply inventory levels, shipyard work load plans, production levels, etc. These are reflected in an operational plan such as a yearly budget. Operational planning is more concerned with projecting the present into the immediate future and in the achievement of greater efficiency and coordination among the several elements of the operating activity in question.

4. Management and Planning

Virtually all management theorists agree that planning is a major element of the manager's job. However, there is no general agreement concerning precisely what

constitues planning. As the term is used here, it encompasses the activities which are variously referred to as goal setting, policy making, strategic planning, and strategic decision making. This interpretation of planning thereby involves the identification of the broad goals of the organization and the specification of strategic policies which prescribe the way in which the organization will go about achieving its goals.

Another interpretation of planning incorporates the "process of preparing for the commitment of resources in the most economical fashion, and, by preparing, or allowing this commitment to be made less disruptively" [1:10]. This interpretation of planning is usually referred to as long-range planning since it involves explicit consideration of the (sometimes distant) future; and it is this phase of planning which is most commonly formalized in organizations. It involves the adoption of general goals and translating them into specific objectives, analyzing which objectives are consistent with those goals, and developing ways of achieving the objectives. The planning process therefore also encompasses the process of strategic decision making which addresses the alternative allocations of resources which will achieve the organization's goals and objectives to the greatest degree.

5. Approach to Planning

The success and failure in planning relate to a very great extent to the understanding and participation of senior management. One of the secrets of participative management

is the allocation of time and attention to the right things, not to those things best left to functional and middle management.

The proper approach to planning is never quite the same from project to project, or for that matter from time to time on the same project. It is always peculiar to the time and place. The planner's most important role is to develop an approach peculiar to his project's time and place. To do so requires a full appreciation of the frame of reference within which he must guide the planning efforts. He must personally understand and develop understanding among the project decision makers that the thought processes involved in making choices among alternatives are what really matter, not the bound volumes of five-year plans to which they can proudly point. He must insure that choices made at all levels and on a myriad of projects are in support of the much broader ones made earlier concerning overall objectives, goals, and strategies. These choices must be made continually throughout the year and generally cannot be deferred until an annual planning exercise rolls around.

> "The task of the planner, including the financial manager, is to present management with that full spectrum of intelligence and data, properly constructed to management's particular needs instead of according to the dictates of our real and imagined professional standards, techniques, and traditions" [16:54].

B. LONG-RANGE PLANS

Long-range plans differ from the short-range plans in that they reach much further into the future. Construction of a large industrial facility such as a naval shipyard may well take more than five years from design and development to completion and eventually operation. In such a long-range time frame many changes can take place. The further ahead we look, the more change we should expect and the more time needs to be devoted to planning.

In general, long-range planning will look to the distant future as far as a trend can be predicted. "Long-range planning needs strong top-level support because of the major commitments that have to be made to carry it out" [17:180]. Support from the higher authority is also needed to get responsible departments/ministries to work toward common long-range goals instead of each going his own way. In a complex project such as construction and activation of a naval shipyard, it may take ten years or even a generation to see the result of a decision made today. For example, a long-range personnel plan for activation of a newly established shipyard should be more than just looking at the number of men and skills required for the start-up of the shipyard. In fact, it should also look much further to the future expansion of the navy; the modern ships and the future equipment that will be introduced, and new technological breakthroughs. Thus, a long-range personnel plan must look at least ten years into the future and anticipate the demand

for manpower and different skills to satisfy the navy's future requirements. Long-range manpower plans should tell us how many managers/officers, civilians or enlisted men we will need in the years ahead, not only for activation, but also for the shipyard's anticipated future growth needs. Included should be an analysis of the job categories, the number of personnel required in each, and skill levels needed. We then can take a manpower inventory and see how the men we now have compare with those we need in the more distant future. We can now start to train today's junior officers/managers, and enlisted men/civilian personnel for the future assignments. They should be given the kind of training and experience that will prepare them for their future jobs. One apparent disadvantage of long-range planning is that it may take ten years or longer to see the outcome of a decision. For example, the decision process to build a shipyard or a dam and the eventual construction period may take well over five years. Hence uncertainties involved in long-range planning should be considered so that the plan may be revised or modified to meet the new requirements. Good management should be forward-looking and prepare a long-range plan, even though it must be updated or revised periodically. Since we cannot tell with certainty what the future will be, it is essential to have some alternatives or contingency plans. Such plans are discussed in the following section.

C. CONTINGENCY PLANS

Even the best plans can be outdated or rendered useless by unforeseen changes or realities involving the project. New technological breakthroughs, innumerable imponderables, unforeseen changes, unknowns and conflicting views and interests can all destroy a "perfect" plan.

> "Especially vulnerable to these threats are those projects on the scientific frontiers, or forefronts, or new technologies, or those where powerful, conflicting interests are involved" (e.g. unexpected expansion or contraction of the project) [18:38].

To retain flexibility and be able to react to these threats, one must be cognizant of three dominant factors in any project. First, is the fact that all projects are interdependent. An action in one area must result in a reaction in another area, when required, or catastrophic results can occur. Another problem is called "second-order consequences". For example, building bigger ships or initially acquiring submarines for the fleet can be a project's main goal; however, deeper port facilities, additional support facilities (larger drydocks), special personnel training and a multitude of other things must be obtained in a timely manner in order to properly support the new ships or submarines. These additional dynamic problems have been especially prevalent in logistical support areas in recent years.

The third area of concern is called "time skip". This is epitomized by the statement heard after a project has blown up, "We didn't think it would be a problem". Seemingly

insignifcant details or oversights can mushroom into gigantic problems [19:38].

An expert project planner will recognize these pitfalls and counter them with contingency plans based on three principles. The first is iterative planning. Plans must undergo continuous modifications in line of these unanticipated realities. Concepts, assumptions and technological features must be constantly reexamined to determine what impact a breakthrough or change may have on the plan. A built-in flexibility to react is essential. Closely related to that premise is the need to build in padding or extra tolerances as insurance for contingencies. Finally, a dynamic, flexible planning effort must be extended over time as well, maximizing interactions within the project and outside efforts. Time delays, and early completions, must be analyzed for their impacts. To aid these plans, information must flow freely in all directions.

D. PLANNING AND COORDINATION

One cannot coordinate activities which are related to one another unless there is prior planning incorporating adequate communication. Most often, we need to coordinate actions because one action must follow another in sequence. For example if we cannot start-up a shipyard, often it is not because of the incompletion of construction or the inability of personnel to run it. There are many other variables which will affect the readiness of a shipyard. For a complex industrial facility, the availability of

qualified personnel, required utilities, adequate housing, supply support, transportation and amenities are equally as important as the availability of buildings and machinery. Sometimes we need to coordinate several actions that start at different times, but should progress together in order to finish together. For example, long before the start of construction of a shipyard, designers start to decide upon its configuration and the personnel department initiates planning for recruitment and training. While someone else plans and prepares electrical power and other utilities (water, steam, gas, etc.), the civil engineers plan for housing, recreation and other community requirements. Suppose that the shipyard is near completion. Initially 200 personnel may be required to oversee test and trials of machinery and to familiarize themselves with the shop's operation. These men need to eat, to wash, and to be treated in case of an accident within the immediate vicinity. They also should have facilities for rest and relaxation for themselves and their families; transportation to get home and other facilities. Therefore we should ask outselves if there are housing and recreation facilities available. Are sufficient utility support, transportation, educational and medical facilities available? Are these personnel trained? Do they know their jobs? Who pays them and how are they getting paid? Who is coordinating all these tasks? By the time the assumed shipyard is completed and ready for acceptance adequate trained personnel should be on the site ready to take-over. Is the arrival

of additional personnel scheduled and coordinated with all other authorities concerned? What happens to coordination if something goes wrong somewhere along the line? Can the problem be avoided? If not, who is going to be affected? Those who are affected should be informed beforehand so that they at least can modify their plans or be prepared for the unpleasant consequences. Often we can break a bottleneck and get the lagging section of the whole activity back on schedule if we know of the problem in time and act upon it soon enough. We may be able to put more people on the job, work overtime, or contract the work or part of the work to an outsider.

Ray Vicker's[8] report on Iran's tremendous progress in a comparatively short period of time emphasizes the importance of the coordination and integrated support.

> "Port facilities were overwhelmed by imports through most of last year and many ships waited three months to unload. Only half the volume of freight that was dumped onto docks could be hauled away promptly by railroad and truck lines, and goods rotted on open wharves. In one instance, several thousand heavy-duty trucks were unloaded at the big port of Kharramshahr, but there weren't any drivers to move them. The new vehicles rusted on docks for months" [20:1].

The article could have continued by asking whether there were adequate: Roads for the transportation? Provisioning for the spare parts? Test equipment and technical documentation? Maintenance facilities? These facets are in fact

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[8]Vicker, Ray: Staf reporter - The Wall Street Journal, 1977, Vol. XCVI, No. 70,[Ref. 20].

the basic elements of integrated logistics support which will be described in the following section.

E. LOGISTIC SUPPORT

One of the greatest challenges facing industry, military and other government managers today and in the future is the growing need for more intelligent management of our scarce resources. The demands of the modern world have created unprecedented incentives for management techniques to design and operate less costly systems, simplify products and processes, and create more efficient supply and distribution methods.

No government agency or private organization can reach its full potential as an efficient allocator of resources until logistic support requirements are properly analyzed and integrated logistics management techniques assume their proper roles in the hierarchy of management activities [21:XV]. It is therefore important that the proper analysis of logistic support of a system or project, whether the acquisition of a new class of ships or construction of a shipyard, be considered at a very early stage. That is, we must look at the "total aspect" of logistics support from the conceptual phase (which is long before any significant investment is committed) to the operational phase. To improve the management of our limited resources, one should view logistics in terms of the effectiveness of support and on the basis of life-cycle-cost. Life-cycle cost includes all costs associated with planning, research, design, production,

system operations and maintenance support, and ultimate system retirement and phase-out. For better appreciation of the subject, this section will present some definitions of logistics; the concepts of integrated logistics system (I.L.S), the system life-cycle and logistic support management.

1. Logistics Definitions

Logistics is not a new subject to us. In fact it has been a concern since the first movement of men and material.

> "Conventionally systems and equipment have been designed and developed and logistic support requirements have evolved "after the fact". This approach to logistics has resulted in high costs of maintenance and support currently being experienced for many systems" [21:XV].

Logistics is defined by Webster's dictionary as "the procurement, maintenance, and transportation of military material, facilities, and personnel." Military logistics as defined by the Joint Chiefs of Staff is:

> "The science of planning and carrying out the movement and maintenance of forces. It is those aspects of military operations which deal with: (a) design and development, acquisition, storage, movement, distribution, maintenance and disposition of material; (b) induction, classification, training, assignment, welfare, movement and separation of personnel; (c) acquisition or construction, maintenance, operation and disposition of facilities; (d) acquisition or furnishing of services. It comprises both planning, including determination of requirements, and implementation" [22:16].

2. Integrated Logistic Support (I.L.S.)

> "Integrated logistic support (I.L.S.) is a management function providing the initial planning, funding and controls which help to assure that the ultimate customer or user will receive a system that will not only meet performance requirements, but one which can be expeditiously

and economically supported throughout its programmed life cycle" [21:7].

The elements of I.L.S. are: personnel and training, supply support, facilities, transportation and handling, test and support equipment, technical data, and maintenance planning. The purpose of I.L.S. is to assure that effective logistic support is planned, acquired and managed as an integrated whole.

DOD directive 4100.35 states that "Military readiness is fundamental to national security and...can best be achieved through effective integrated logistic support of...system and equipment." Its primary objective is "to assure that...effective logistic support...is systematically planned, acquired, and managed as an integrated whole...to obtain maximum material readiness and optimum cost effectiveness" [23:1.2].

The following are brief descriptions of the elements of Integrated Logistics Support:

(a) Personnel and training: The human element is required for the operation and maintenance of the prime system (a shipyard in this case) and associated support facilities throughout the life-cycle. Personnel are identified in terms of numbers and skill level requirements for each operation and maintenance function of the shipyard. The training of personnel includes both the initial training for navy/equipment familiarization and operation of the system, and also the replenishment training to cover

attrition and replacement of personnel. Training is also provided to upgrade the assigned personnel to the skills required for the particular system/equipment.

(b) Supply support: Consists of all general consumable and outfitting materials for the shipyard, repairable spares (units, assemblies, modules), repair parts, consumables, special supplies and related inventories needed to support the shipyard and supporting facilities. Special considerations should be given to the geographical location of the shipyard with respect to where the supply materials originate, are stocked and distributed, the means of transportation and methods of distribution.

(c) Facilities: In general facilities consist of real estate, physical plant, portable buildings, housing, intermediate shops and depots, etc. required to support operation and maintenance functions associated with the prime system. The shipyard here is considered the prime system; hence the housing, drydocks, cranes and rails, and other training and repair facilities, required, to support the shipyard, test and support equipment and training equipment throughout the life-cycle of the shipyard, are the supporting facilities.

(d) Transportation and handling: Consists of all those vehicles, equipments, special provisions, containers and supplies necessary to support packaging, preservation, storage, handling and transportation of, test and support equipments, spare/repair parts, personnel, facilities and technical data.

(e) Test and support equipment: Consists of all monitoring and checkout equipments, tools, meteorology and calibration equipments, maintenance stands and handling equipment required to support scheduled and unscheduled maintenance actions associated with the shipyard.

(f) Technical data: Are the operating and maintenance instructions, drawings, microfilms, inspection and calibration procedures, provisioning and facilities information, specifications, computer programs required to support the construction, checkout, and operation of a shipyard and its supporting facilities.

(g) Maintenance planning: is

> "accomplish through the definition of the maintenance concept, accomplishment of logistic support analyes, provisioning, and assessment and evaluation of the overall support capability with the necessary feedback loop for corrective action and modification" [23:9].

Maintenance planning facilitates the necessary logistic support considerations in the system design process.

3. System Life-Cycle

A system/project in the dynamic sense must be considered through its life-cycle or so called "cradle-to-grave" viewpoint. The system life cycle may be said to originate in the perception of a need and terminate with disposal of the system. Between the two end-points of a system's life, there are a number of phases through which the system passes, e.g. the initial phases of the life cycle of a shipyard project is from the inception to operation

Figure 4. Total Life-Cycle Cost

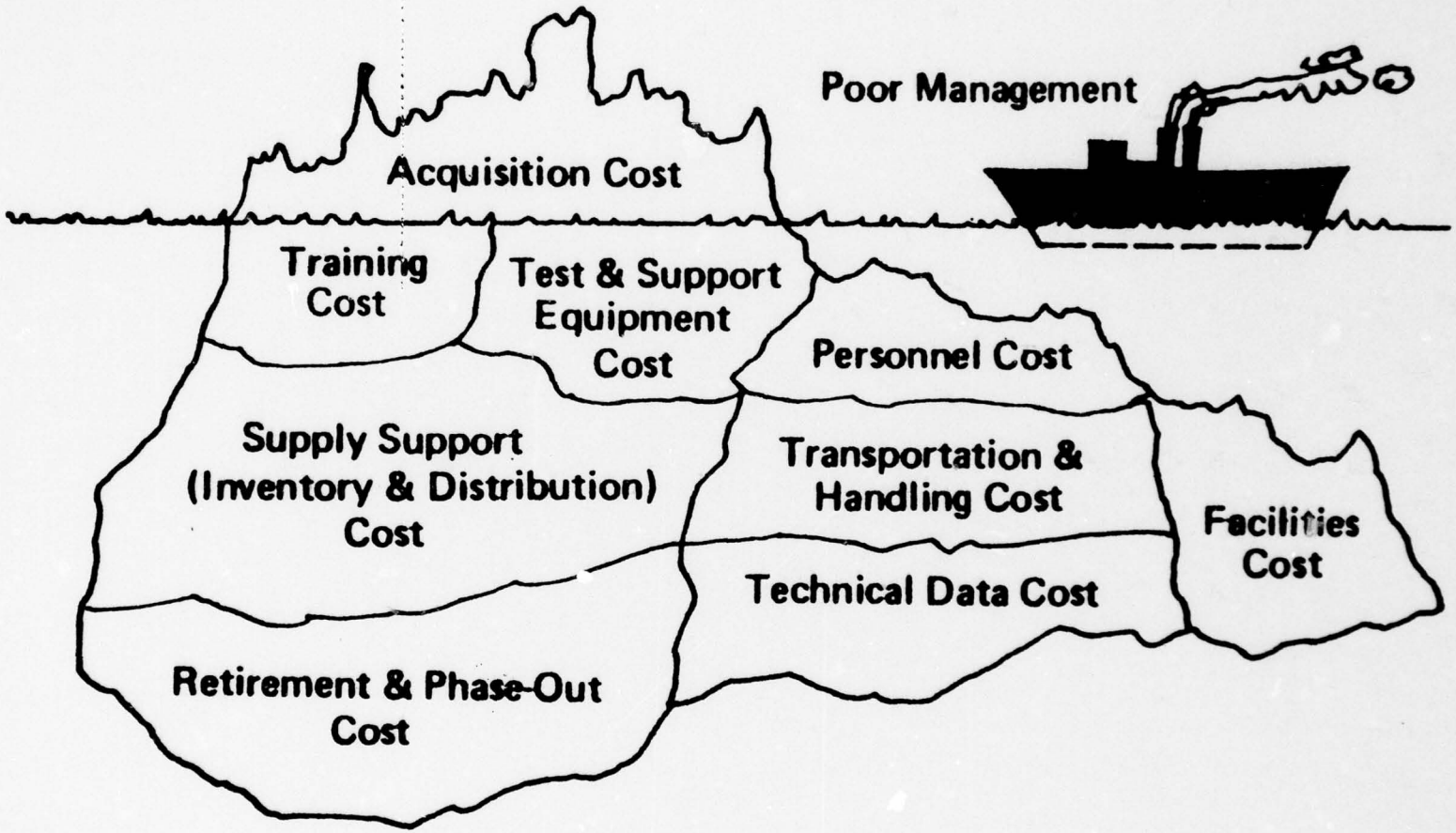

Figure 4

Total Life-Cycle Cost

Source [24:53]

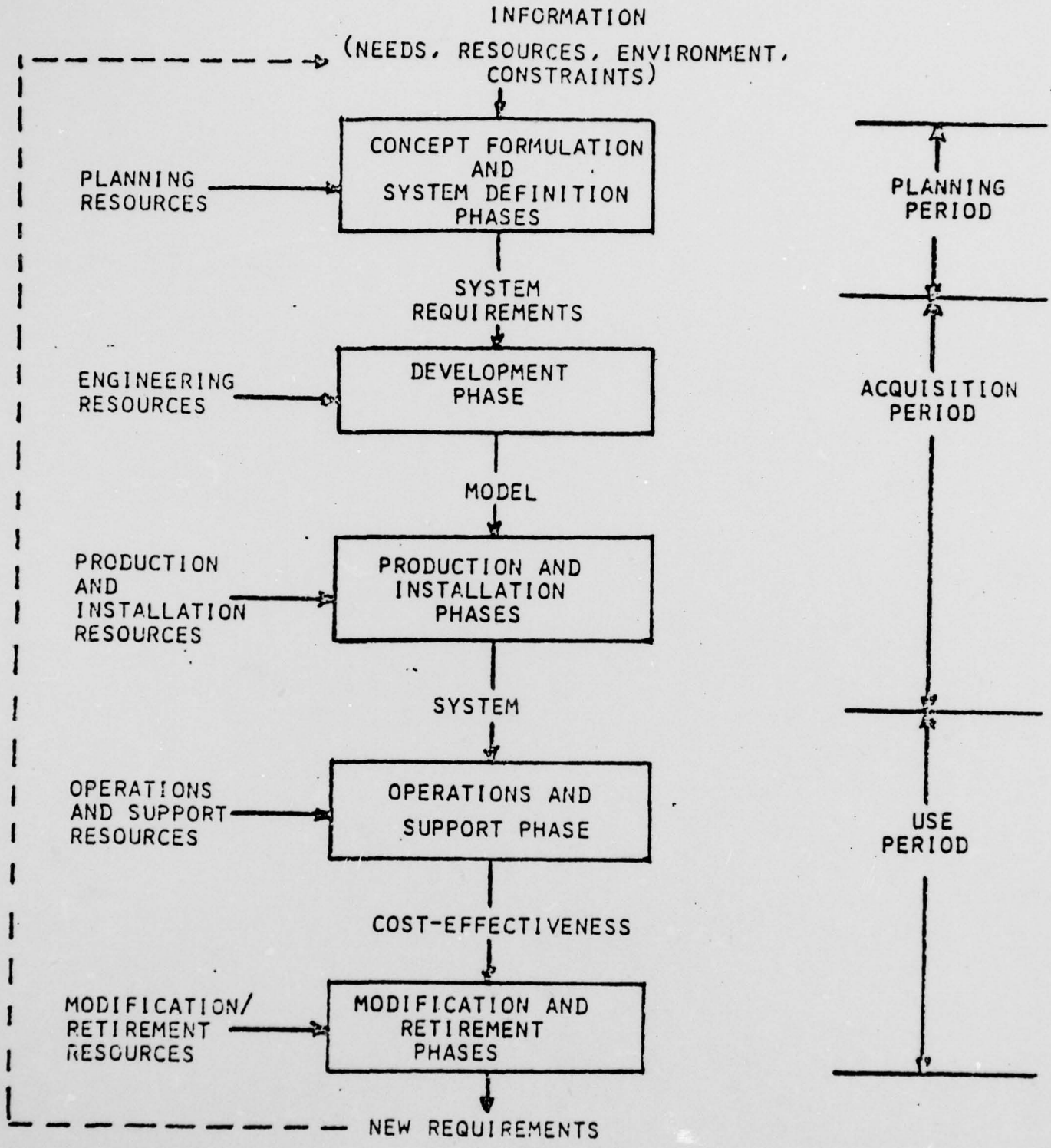

Figure 5

SYSTEM LIFE CYCLE

Source [23:4]

period which may take 5 to 20 years; while the operational phases of the shipyard may be several generations. Figure 4 shows the total life cycle cost of a ship. Note that poor management may only see the acquisition (construction) cost (or the tip of the iceberg). Many other major costs, such as those illustrated[9], may go unnoticed when first viewing the project.

In regard to the system life-cycle, Professor Kline[10] states that "in the gross sense of a system one might consider three distinct periods: the planning period, the acquisition period and the use period" [23:3]. See Figure 5.

The concept of the Integrated Logistics Support calls for people familiar with and responsible for the operation of a system (e.g. shipyard) to be involved in its development and production (construction). Ideally, the individual responsible for the activation and operation of the shipyard should be involved or represented in the development of the plans for the yard--or at least involved in the review of such plans.

Even after the design plans have been developed and construction is under way, there may be occasions where an

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[9]Other costs are: personnel and training, test and support equipment; supply support; transportation and handling; facilities; technical data and eventual retirement and phase-out may seem to be under the surface.

[10]Kline, Melvin B., Professor of Department of Operations Research and Administrative Science, Naval Postgraduate School, Monterey, Calif., 1978.

engineering change (at some cost in time and money) may save many times the initial cost in life-cycle terms.

4. Logistic Support Management

Logistic support management involves the planning, organization, direction, and control of all functions and activities of a program. Management responsibilities for logistic support commence at the early phases of system inception, continue through the systems operational use and to the systems phase-out, or retirement [21:279]. Management functions include the definition and establishment of objectives and organizing and implementing tasks necessary to achieve the desired results. This function also is shared by directing and controlling activities, thus ensuring that results are ultimately attained.

Logistics represents a broad spectrum of activities whose responsibilities are shared by many organizations. In the past, various logistic activities have operated somewhat independently, with results less than effective. The proper integration of the various elements of logistics and the communication between various organizational entities responsible for logistics are the key factors for the success of any program. Logistics support must be recognized at all levels of program management as being a major ingredient in each phase of system development. The elements of support must be properly identified to ensure item acquisition to be accomplished in a timely manner [21:313].

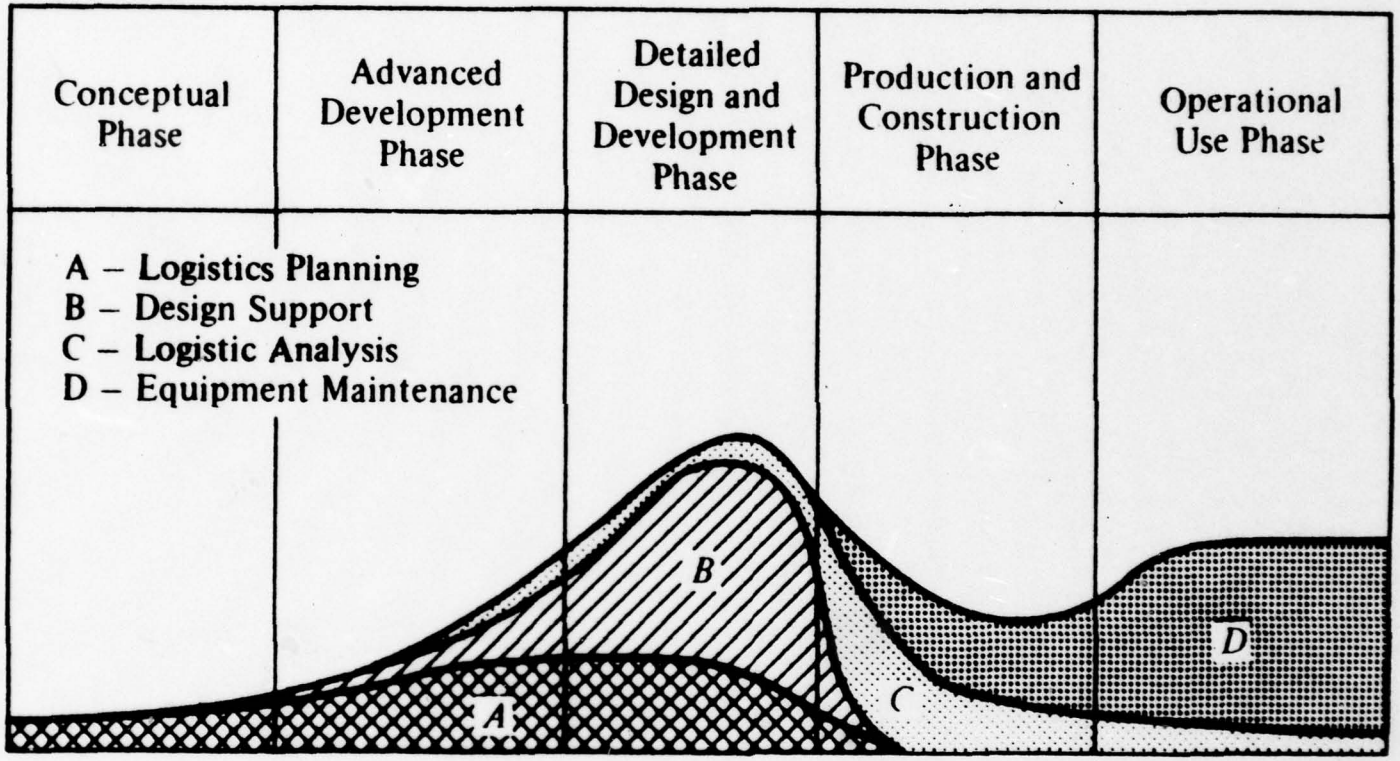

FIGURE 6: System Life-Cycle and Typical Manloading Curves for Integrated Logistics Support

Source: [21:305]

V. PROJECT MANAGEMENT

In the past few decades interest has grown in techniques and approaches for management of temporary projects (in contrast to ongoing operations) in large complex organization. Thus, project management evolved based on the realization that modern organizations are so complex that it is extremely difficult to achieve effective management using traditional organizational structures and relationships based on a vertical flow of authority and responsibility.

Centralized program management was introduced in the United States Department of Defense (D.O.D.) in the 1950's. Before this time, task-oriented management organizations worked on several projects simultaneously [25:169]. A distinct departure from traditional management occurred when the Defense Department recognized the need to streamline the acquisition process and introduced the concept of project management. The key person in that management organization is the project manager, normally, in D.O.D., a senior military officer.

The construction and activation process of a naval shipyard is a notable undertaking and involves a large amount of capital investment. Buildings and machinery will be of little or no value in meeting the objectives of the navy if they cannot be utilized due to the absence of other equally important resources. The mission requirements can only be

met through the integration of trained personnel; supply support; housing and community facilities; utility support; transportation and handling; and the completed naval shipyard. The optimum utilization of all these resources requires proper control of this investment through an organized and effective management information and decision system. One must appreciate that the total program consists of a number of individual but highly interrelated projects. Completion of any single project requires an organized and dynamic management system that can co-ordinate activities within that project from beginning to end and meet the desired completion date. Understanding and utilizing the concepts of project management is essential to the success of each project and thus to the overall program. Hence in this section the general characteristics of project/program management and information systems are described. Also management functions such as: organization and staffing, planning, scheduling, and control are discussed.

A. GENERAL CHARACTERISTIC

The terms "program" and "project" frequently are interchanged. To avoid ambiguity in this thesis it is appropriate to distinguish a project from a program. Cleland and King state:

> The project can best be distinguished from a program in terms of scale. Programs generally are larger and more directly related to basic organizational objectives than are projects. Any one program of an organization might be composed of many different projects which in sum will aid in achieving a specific output-oriented

> objective of the organization. Programs also may be open ended in nature, while projects have specific objectives and specific end points [19:184].

Therefore the development of a naval shipyard may be viewed as a major program consisting of several projects. These projects may be grouped as (1) the construction of facilities and (2) the activation of the shipyard. The first group of projects may include construction of: (a) housing and community facilities, (b) port facilities, (c) the shipyard, (d) roads and communication centers, (e) industrial utilities, and (f) other support facilities. The activation group of projects includes: (a) personnel and training, (b) supply support, (c) management information systems (MIS), (d) shipyard organization, etc. However, each of the major projects is a separate but interrelated aspect of the total development program. Before further discussion of the subject one should understand "project/program" and "program manager".

Generally, projects or programs have: (1) an objective that is known and can be specified; (2) an anticipated date of completion; (3) actions and activities to accomplish the objective that can be determined in advance; (4) a desired or required sequence for performing the activities [19:341].

The program under consideration here is the activation of a naval shipyard, which encompasses not only the construction of the shipyard, naval base, utility support; housing and community facilities; but equally, if not more

importantly, the overall task of providing for integrated logistics support; and establishing an operating organization and the management information systems for the shipyard.

The complexity of major projects have caused revolutionary changes in the fashion in which decisions are implemented. The most striking example of this is the emergence of the "program manager".

"The program manager may be defined as that individual who is appointed to accomplish the task of integrating functional and extraorganizational efforts directed toward the successful performance of a specific program" [19:18]. The program manager is faced with a unique set of circumstances with each project, and these situations direct his thought and behavior into achieving the total program-specific goals. The program manager faces a complex managerial activity consisting of a broad spectrum of authority and responsibility.

In the previous chapter, the system life-cycle was defined. It is appropriate at this point that a project/program life-cycle be discussed. Figure 7 presents a comparative view of the systems life-cycle and the program office life-cycle.

A brief description of each phase of a project/program follows:

1. Conceptual Phase

This is the period in which the idea is conceived and given preliminary evaluation. An idea may originate

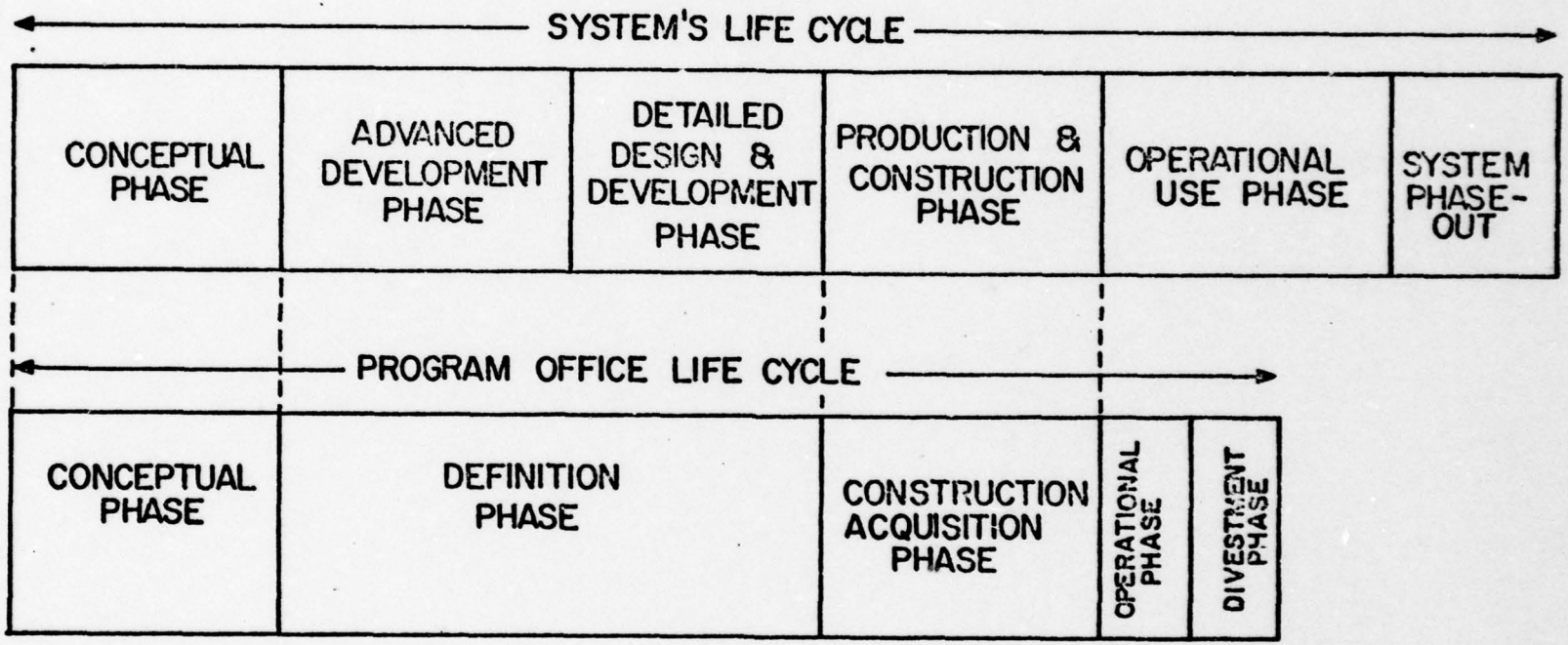

Figure 7. Systems life-cycle vs program office life-cycle.

from basic research, a current organization problem or an external influence[11]. During this phase, the environment, forecasts, objectives and alternatives are examined and evaluated. There is a first look at performance, cost and time aspects of the project. It is the period in which basic strategies, organization, and resources (men and materials) requirements are conceived. Also during this phase the overall scope and direction of the project will emerge.

2. Definition Phase

The purpose of the definition phase is to determine, as accurately as possible, the cost, schedule, performance, and resource requirements and how they fit together. This phase identifies in more detail what is to be done, when it is to be done, how it will be accomplished, and how much it will cost.[12] During the definition phase the organization must reevaluate the projects (total program) and reaffirm its objectives before resources are committed to the acquisition (of men and materials) and the construction phase. When clearly defined, contracts may be awarded during this stage.

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[11]For example, the need of a country to build a shipyard for the maintenance of the fleet for defense against external threats.

[12]One should look at the cost as the total life-cycle costs and not merely the construction/acquisition cost. See Chapter IV Section E-3.

3. Construction and Acquisition Phase

The system (shipyard, support facilities and personnel, etc.) elements are constructed/acquired and tested individually and as a total system, using the procedures and standards developed during the preceding phases. The construction/acquisition process involves such things as the actual procurement, construction of facilities, personnel training, identification and ordering of long lead time materials (supplies and test equipment), allocation of authority and responsibility and finalization of the supporting documentations. The recruitment and training of some skilled personnel will probably start during the previous phases of the project.

4. Operational Phase

Reaching the operational phase indicates that the system has been tested satisfactorily; proven economical, feasible, and practicable; and is ready to be employed toward the attainment of the larger goals of the organization. This is the phase in which the results of the efforts taken in earlier phases of the program often come to fruition.

"Activation" of a naval shipyard is the start of its operational phase. This is the time where the planning and coordination for the masses of men and material results in a successful mission accomplishment. The fundamental role of the program manager during this phase is to provide the resource support required to accomplish the navy's objectives

for establishing a shipyard. The functions of the program manager change somewhat in this phase. He becomes more concerned with controlling the system's operation along the predetermined lines of performance. He also places more emphasis on motivating the human element of the system and controlling the utilization of resources of the total system. This is the period during which the completed and operational shipyard is successfully turned over to the user, "the shipyard commander" for the service of the fleet.

5. Divestment Phase[13]

The project organization/program office eventually will be dismantled since a program/project does not have a finite life. The responsibility of each project (i.e., the shipyard, naval base, etc.) is transferred to supporting organizations (i.e. technical directors) and the program office resources are directed to other areas.

The "final report" submitted and the "lessons learned" are most important documents for future projects and should be included in the data base of the organization's M.I.S.[14]

We will now discuss the issues of organization and staffing, scheduling, and control. In the following sections each of these functions will be briefly described.

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[13]Note to the reader. The term 'divestment phase' is applied in this instance to the program office and not to the shipyard. (See Figure 7).

[14]Management Information System (MIS), see Section F of this chapter.

B. ORGANIZATION AND STAFFING

One of the most notable contributions to management theory and practice has been the development of the project management concept. Not only have revolutionary organizational approaches been developed to facilitate the effective integration of people, resources, and tasks, but equally important, powerful management systems have been devised to monitor and control projects. The success or failure of a program is highly dependent upon the quality of the staff and organizational structure that is employed. With this in mind, the characteristics and concepts of project organization and staffing requirements will be described. The proposed program organization and staffing for the activation of the shipyard will be presented in Chapter VI.

1. Program Organization

Organizational structures can vary from the pure functional model at one extreme to the pure project model at the other extreme. The matrix structure rests somewhere between these models on the continuum, and has characteristics of both. A brief description of each of the organization alternatives follows:

a. Functional Organization

The functional structure is also known as the traditional or bureaucratic structure. It is the most prevalent organizational structure in the world today (Figure 8).

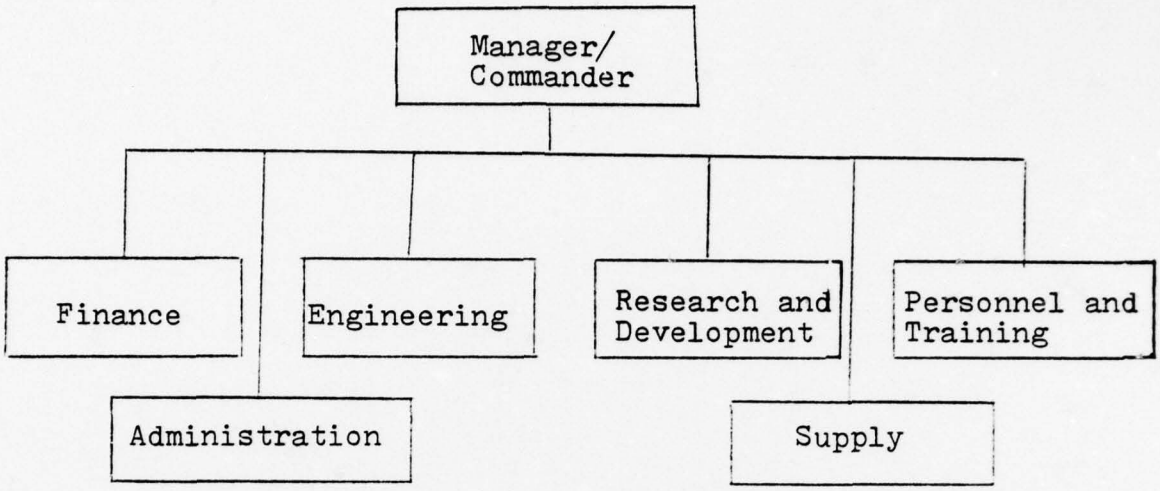

Figure 8. Functional Organization

This is the basic hierarchical structure with top management on the upper level of the chart and middle and lower management spreading out down the pyramid. The organization is usually broke down into different functional departments, such as personnel and training, supply, research and development, engineering, administration, and finance. This hierarchical structure was originally based on such management theories as specialization, line and staff relations, authority and responsibility and span of control [26:46]. It is generally considered easier to manage specialists if they are grouped together and if the department head has the same training and experience in the particular field. A primary characteristic of the functional organization is the division of labor into specialized groups. Its strength lies in its centralization of similar resources.

This form of organization has a number of weaknesses. For example, when involved in multiple projects, conflicts may arise over the relative priorities of these projects in the competition for resources. Also, the functional department often places more emphasis on its own specialty than on the overall goals of the organization. This creates integration and communication problems that hinder the progress of projects.

b. Project Organization

The project structure emphasizes the project rather than the specialized functions. That is, all the resources of the various functional specialists necessary to attain a specific objective are set up in a self-contained unit headed by a program/project manager. This individual is given considerable authority over the project and may acquire resources from inside or outside the overall organization [26:47] (Figure 9). As it is seen from the chart, the internal organizational structure of the project organization is functional, that is the project/program team is separated from the various functional disciplines. The major advantages of the project organization are the singleness of purpose and the unity of command. Informal communication and clear understanding is effective in a closely knit team, and the program manager has all the personnel resources required under his direct control. The project structure is optimal for very large projects. The major disadvantage of such an approach is that it requires a

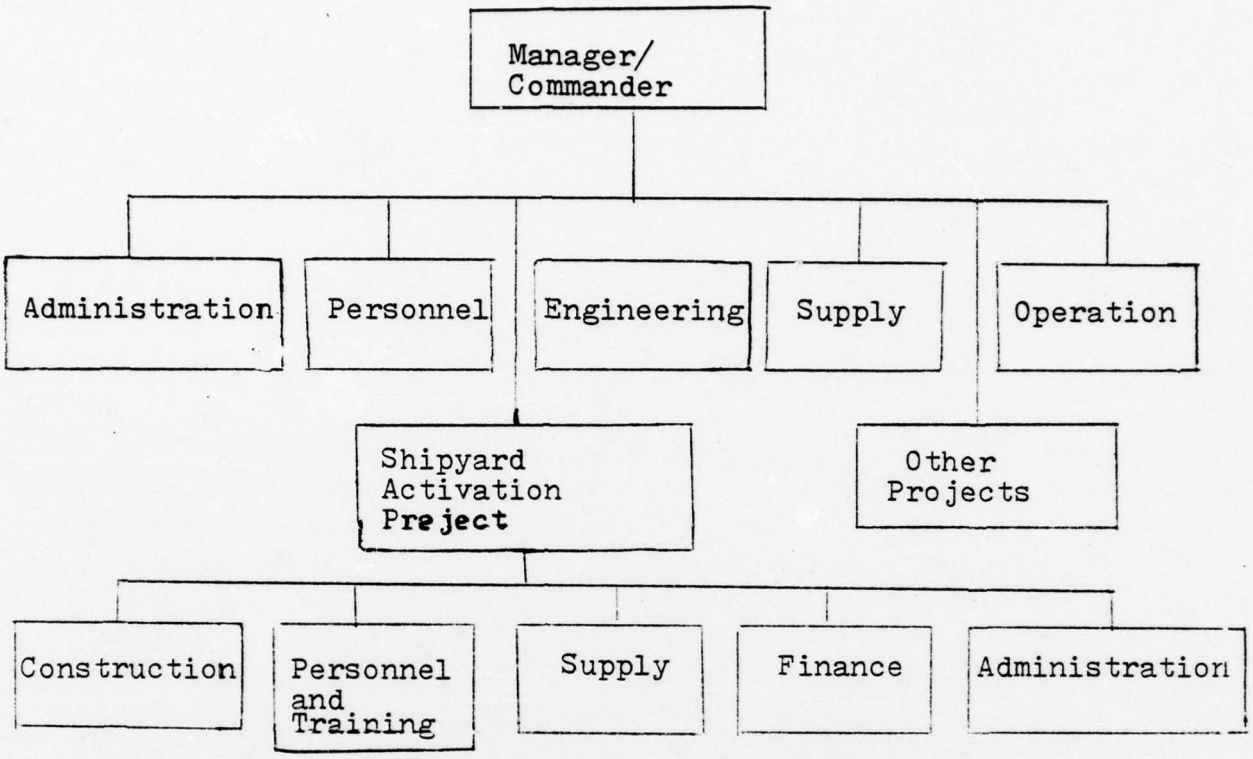

Figure 9. Project Organization

large number of full time personnel. Such an investment may be appropriate for a small number of critically important programs. However, resource limitations preclude the use of the project organization approach for all programs. Thus, for a large-scale program such as development or activation of a naval shipyard even though this single purpose project organization may seem suitable for the choice of organizational structure, the personal constraints may preclude such a luxury.

C. MATRIX ORGANIZATION

The matrix structure tries to maximize the strengths and minimize the weaknesses of both the project and the functional structure. It retains the functional specialties and overlays a project organization with a single program manager (Figure 10). The project organization emphasizes completion of the program, while the functional organization pursues the various specialties.

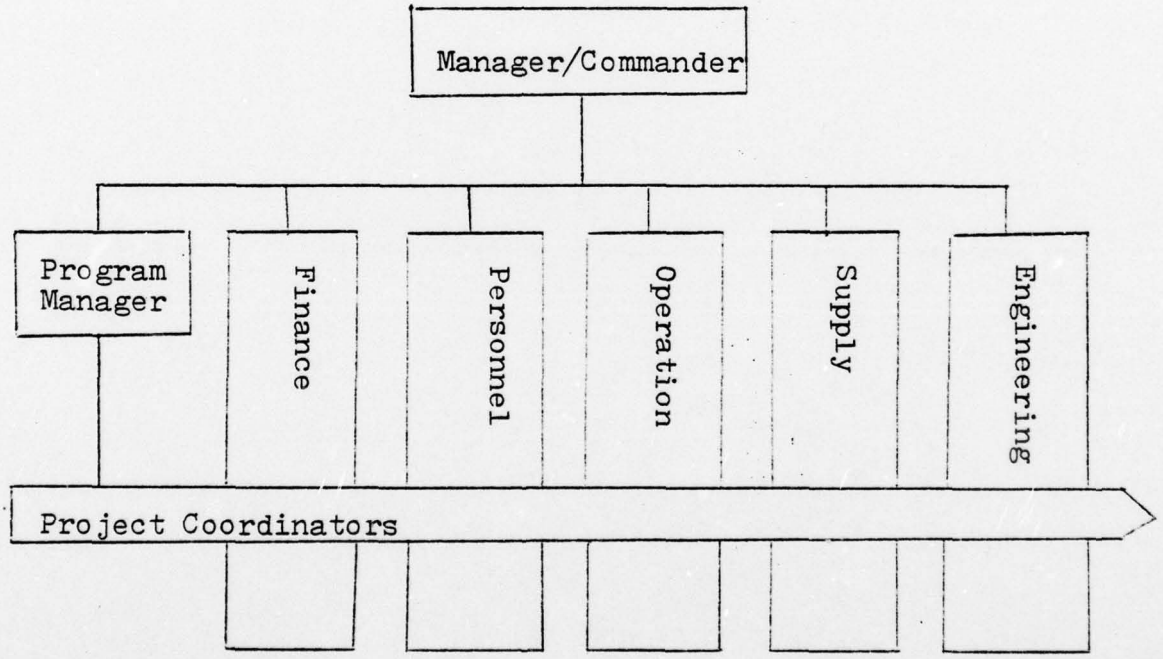

Figure 10. Matrix Organization

The major benefits of the matrix organization are the balancing of objectives, the coordination across functional department lines, and the visibility of the program objectives to the project coordinators. The major disadvantage of this form of organization is that an individual is working for two superiors. He is reporting vertically to his functional department head and horizontally to the program manager. The project/program managers often feel that they have little authority over the functional departments. The functional department head also feels that the project coordinator is interfacing in his job. The solution to this problem is the clear definition of roles, responsibility and authority coordinator specifies what and when a task is to be done and the functional departments are responsible for how it should be done.

Considering the shortage of qualified personnel to plan for and direct the activities of the shipyard, some form of matrix organization may be most appropriate.[15]

Regardless of the organizational structure used, the program management's task is by no means an easy one. For the management of the activation program he relies heavily on his staff to monitor and control the functions of an extremely complex program.

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[15]The recommended organizational structure for the proposed program office will be presented in Cahpter VI "Activation Program".

2. Project Staffing

The nature of the program itself will have considerable impact on the kind of staff required. The project team generally includes the permanent members of the program office as well as all the functional contributors (coordinators) to the projects. The management functions to be accomplished during completion of the overall program are those necessary to enable the program manager to fulfill his basic responsibility. "This encompasses the overall direction and coordination of the program through all of its phases to achieve the desired results within established budget and schedule" [14:112]. As a general rule, the number of individuals working in the program office under the direct supervision of the program manager should be as small as possible. This emphasizes the responsibility of each functional department for its contribution to the program while retaining the maximum benefits of a specialized work force. It also increases the flexibility of the project staff; reduces cost; and allows the program manager to devote maximum effort to the program itself, rather than supervising a large staff. Archibald[16] states that the individuals who should be assigned permanently to the program office are those who: (1) deal with the management aspects of the project; (2) are required on a full-time basis for at least six months; (3) must maintain close

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[16]Archibald, Russell D. is the author of "Managing High Technology Programs and Projects" see [reference 14].

contact with the program manager and his staff in the performance of his duty; (4) cannot otherwise be controlled effectively, due to organizational and geographical considerations.

Some of the key members of the project team may be: the program/project manager, executive assistant, director of personnel and training, director of logistic support, director of systems requirements, director of plans and programs, contract administrator, program controller, program accountant, construction coordinator; organizational development consultant, community development specialist, purchasing and subcontractor coordinator, and field project manager.

With adequate project planning and control procedures, a qualified project staff can maintain the desired control of the complex program. The quality of the staff assigned to the program is often more important than the number of personnel assigned. Early in the program, the program manager must indicate to higher authority the number and the skill of personnel he requires. Baumgartner states that "The project staff must be top notch, as concerns technical expertise and as far as tact, judgment, and other team-making traits are concerned" [26:27].

In the following section, the staffing procedure and some of the criteria for selection of the program manager will be discussed.

a. Staffing Procedure

The following procedural list is one of many general methods offered for the task of staffing an organization. It is general enough to allow application to any organization.

(1) Define output/objectives;

(2) define and allocate budget;

(3) set up or modify the organization;

(4) develop position descriptions;

(5) define training requirements (professional and on-the-job);

(6) define minimum requirements for applicants;

(7) advertise;

(8) interview;

(9) hire;

(10) train and assign; and

(11) operate and manage [27:43].

A process very similar to this has been conducted by many organizations such as the National Aeronautics and Space Administration (NASA) for personnel selection. It must be recognized that the staffing process is highly dependent on the type of organization chosen to meet the objectives. Depending on the three types of organization described earlier; functional, project and matrix, the personnel requirements vary considerably.

b. Program Manager Selection

The program manager should be designated for each major program/project as early as possible. The objectives of the office and the standards set for the applicants are the prime considerations for this selection. The objectives which the program manager and his staff are to meet should be incorporated in a written charter which defines the authority, responsibility, and accountability of the program manager. As a result of these objectives, the program manager's role may be defined to include: (1) overseeing the acquisition of the system (e.g. activitation of a shipyard) within constraints; (2) meeting performance objectives; (3) alerting higher authority when it appears a technical, cost, or time objective will not be met; (4) making required decisions; (5) recommending termination or alternate solutions; (6) being the prime point of contact for the program; and (7) negotiating as required with functional groups and contractors [27:45].

C. PROJECT PLANNING

Many concepts and the importance of planning have been discussed in the previous chapter. The importance of project planning has been stated by Baumgartner thusly:

> No other activity has more far-reaching effect on the project, extent, detail and realism of project than planning. Most problems can be traced back to faulty planning...Behind these difficulties usually lies the failure to plan for planning, the omission of determining what plans are needed, why and where [26:9].

Elements of project planning include: scheduling, budgeting, contingency planning, forecasting, transition planning, planning for change, organizational planning, facilities planning, personnel planning, fiscal planning and reports planning. All these planning requirements, to one degree or another, must be coordinated by a project manager. He is the one who must perform the key planning work at the master schedule level to give adequate direction to those who will perform the detailed planning and control the work just cited. On his shoulders falls the full responsibility for assuring all plans and schedules are valid and integrated into a total project plan. Additionally, he must assure that the planning and control functions are performed properly and in a timely basis by all members on the project team. "All of these efforts must be oriented to the main objective, the earliest completion of the project within monetary, quality and time constraints, at the least risk" [14:135]. Succinctly stated, the initial operations plan which the project manager must develop will be the keystone on which the project's success or failure is based. In this section the planning process and planning methods for any major project will be described.

1. The Planning Process

The professional project planner believes in the need for project planning because a poor planning process can lead to:

- Loss of control due to ineffective budgeting
- Loss of control due to unrealistic scheduling
- Loss of control by not organizing for effective action
- Loss of control over contractors functional activities providing support
- Loss of cost control by unrealistic estimates incurring undue risks, and insufficient preparation
- Loss of morale and incentive on the part of project personnel, resulting in cost overruns and delinquent deliveries
- Loss of confidence by the superiors (the CNO)
- Loss of the project [2614]

The planning process used for project planning is very similar to the scientific, problem solving method employed by engineers and scientists world-wide. It begins by establishing general goals of objectives. Information is then collected and a general forecast made to limit the scope of the study. Assumptions are then made based on the previous steps. Specific objectives are established such as workload and manpower level, cost control guidelines, schedule of completion, activation date, performance criteria, etc. Managers should expect and be prepared for changes in this one step, more than any other.

It is important that all involved in the planning process are actively aware of the interdependence in a project's plan. A cliche common in project management will depend on facts and assumptions made previously, often based on insufficient information. If those facts and assumptions are changed then the later steps in the process can become totally invalid. However, no one should expect results and past plans to be in perfect agreement, or even expect past

plans and present plans for the same time period to agree. Certainly these deviations should be explained, and changes based on this new information brought out into the open and fully discussed. The interdependency role in the planning process has often been overlooked, resulting in disastrous consequences at a later date [19:42-48].

The ultimate goal of the professional planner is to achieve three objectives from the planning process. First, he wants a clear understanding of <u>future problems</u> and the impact they will have on present decisions. With this knowledge he will attempt to anticipate areas that will require <u>future decisions or changes</u> and be prepared to make those decisions on a timely basis. Secondly, he wants to establish an effective management information and control system to expedite the flow of relevant information that will impact on the project's objectives. Finally, he wants to provide for faster, and less disruptive implementation of any change required by future decisions. Each of these requires a thorough appreciation of the planning process, and its role in the project and subsequent actions each may entail. The result of an effective planning process and a project team fully appreciative of that process is a plan that will:

- Translate broad goals into specific measurable objectives
- Establish priorities
- Identify what must be done to obtain results
- Allocate human and material resources

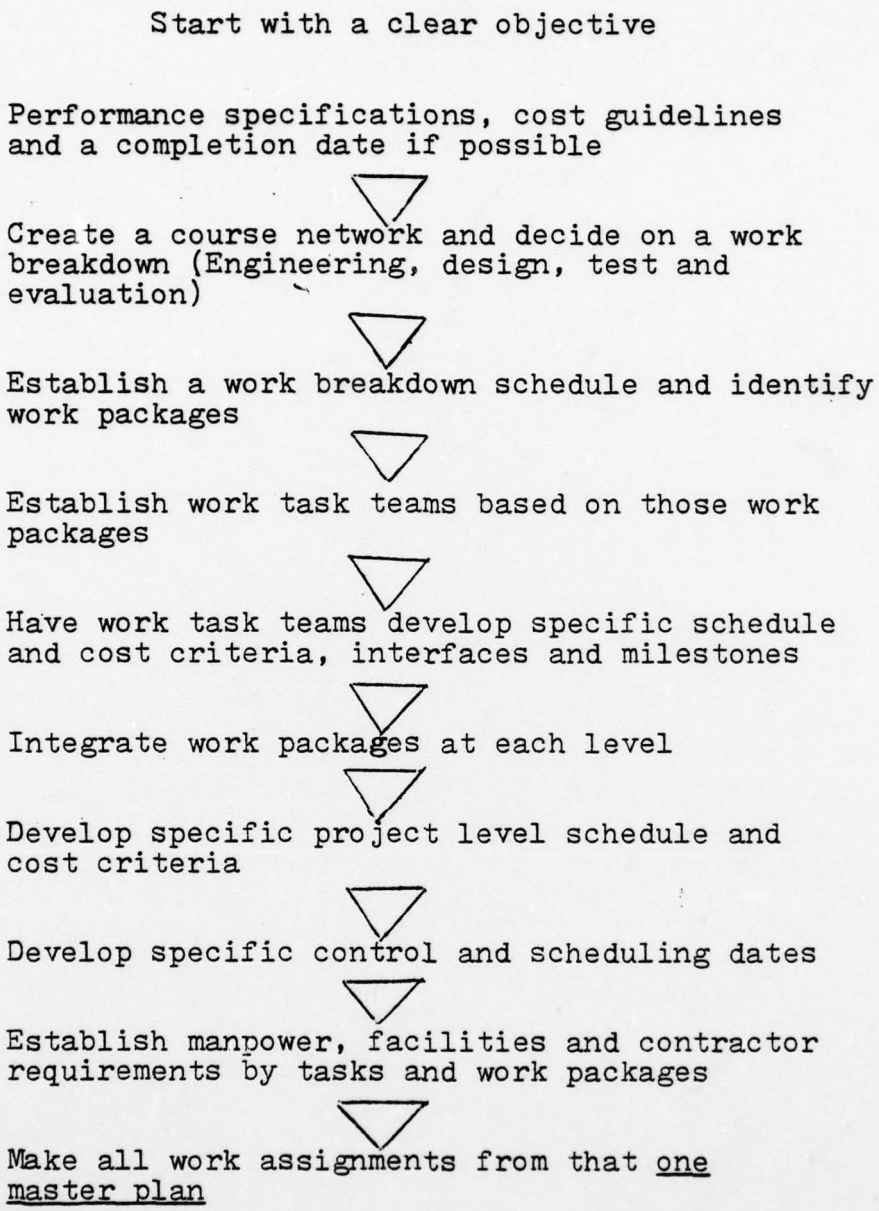

Figure 11. Sequential Guidelines

Source [28:62]

. Specify when each activity must occur

. Evaluate progress against scheduled activities

2. Formulating the Plan

Once the project manager has completed an initial review and analysis of the problem and the project team is aware of time, quality and completion date constraints, the project manager can begin developing a specific plan for the project. Furthermore, each member of the project can begin to develop his functional area of the project along the sequential guidelines shown in Figure 11.

As can be seen the entire project becomes more specific at each level. A key element to an effective project plans execution is how the work breakdown is accomplished. It is imperative that manageable units are formed that are clearly the responsibility of a functional manager. However, the final chart should not be considered an organizational chart, since one manager may have responsibilities in several functional areas, in addition to his own [14:143].

Once initial planning and approvals for a project are accomplished, the actual development phase can begin. An important step in this phase is development of a progress schedule, a time table of the work activities.

D. PROJECT SCHEDULING

In the development and acquisition of a major program, such as activation of a shipyard or construction of a new ship, progress towards the deadlines and cost targets requires more advanced scheduling techniques than traditional methods. The Aerospace industry and the U. S. Department of Defense in recent years have devoted considerable effort in advancing methods to track the cost, performance, and scheduling of development progress [19:317]. This section briefly describes some of the scheduling techniques currently available to project management with emphasis on the advanced scheduling techniques of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM).

It should be well recognized that the construction of a shipyard and its activation process are long-term programs with built-in uncertainties and dynamic variables. Numerous government agencies and firms are involved in such programs. A clear understanding of the environment, the hierarchies of the program management, and the tremendous task of coordination is essential to an understanding of the importance of scheduling. Common scheduling techniques will now be described.

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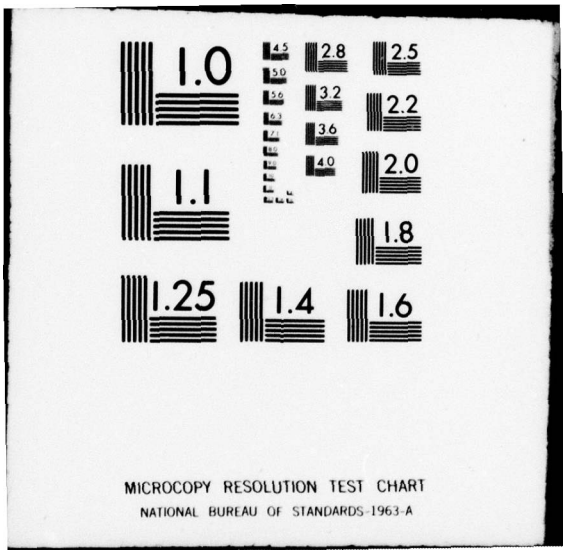
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

1. Bar Chart

The Bar Chart approach to scheduling was developed by GANTT[17] in the context of a World War I military and industrial requirements. "This tool made it possible for the first time to compare actual performance against the original plan, and to adjust daily schedules in accordance with capacity, backlog and customer requirements" [29:14]. An example of Gantt Bar Chart is shown in Figure 12.

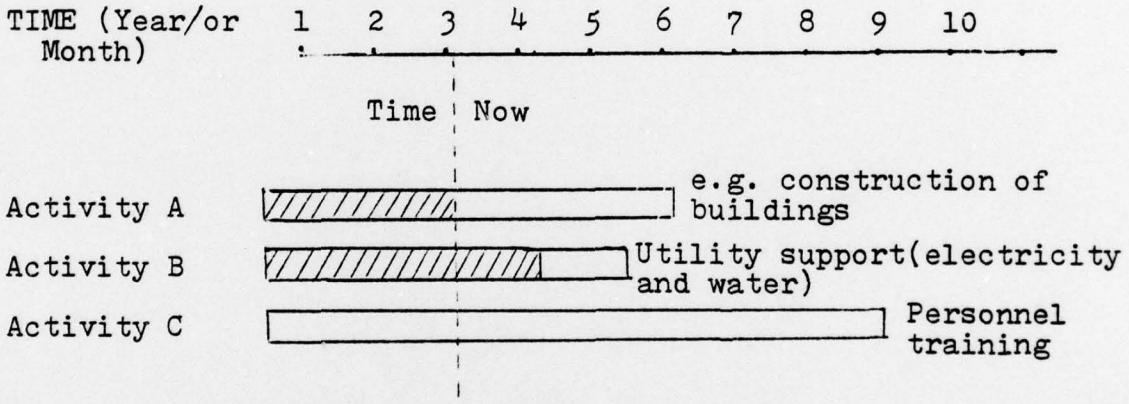

Figure 12

Activities A, B and C may be, for example, the construction of buildings, utility support (i.e. electricity and water) and personnel training respectively. In terms of being

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[17]Gantt, Henry Laurence developed the production control tool "Bar Chart" in 1917. This chart measures performance while usually showing projected schedules. It was enthusiastically adopted by the shipbuilding industry during World War I.

"on" or "off" schedule, the status of each activity is:

Activity A "Construction of Buildings" is on schedule;

Activity B "Utility Support" is ahead of schedule; and

Activity C "Personnel Training" has not yet started.

2. Simple Scheduling Example

Scheduling is defined as: "the specification of dates and times for performing functions and implementing the many subplans of the projects...consisting of transplanting the schedule into actual calendar dates and times" [19:327].

A practical example for representation of overall scheduling for construction and activation of the shipyard follows:

Activities	Start Date	Duration Estimate (Months)
1. Harbor and Piers		
a. Design Harbor	Jan. 78	6
b. Construction of Piers	Mar. 79	27
c. Design Breakwater	Jan. 78	6
d. Approve Design by Owner	Mar. 78	9
e. Construction of Breakwater	Dec. 78	31
2. Intermediate Repair Activity (IMA)		
a. Initial Layout Preliminary	Aug. 78	4
b. Detail Design	Dec. 78	8
c. Procurement	Dec. 78	24
d. Construction	Dec. 78	12
3. Buildings and Shops		
a. Preliminary Design	Jan. 79	20
b. Detail Design	Mar. 79	24
c. Approval of Design	May 79	22
d. Construction	Jun. 80	24

4.	Utility and Services		
	a. Preliminary Design	Jan. 78	5
	b. Detail Design	May 78	13
	c. Procurement	Aug. 78	21
	d. Construction	Sep. 78	22
5.	Personnel and Training		
	a. Authorization	Jan. 78	6
	b. Recruitmen 1st Stage[18]	July 78	6
	c. Initial Training (Familiarization and Language Training)	Jan. 79	6
	d. Apprentice Training	July 79	36
	e. Recruitment 2nd Stage	Jan. 79	6
	f. Familiar. & Lang. Training (2nd)	July 79	6
	g. Apprentice Training (2nd)	Jan. 80	36

The charts in both Figures 12 and 13 display the initial starting dates, the project status now, and the expected completion dates, but do not indicate precedence relationship among the activities. The bar chart, as well as other approaches which evolved from it such as Line-of-Balance (LOB) and Milestone Methods[19], were not too successful on one-time projects. Here is where some of the other advanced project networks such as PERT, CPM, GERT, and SKED[20] may be more useful.

3. PERT and CPM Network

Development of "Program Evaluation and Review Technique" (PERT) began in 1958, when the United States Navy

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[18]Large numbers of many different skills are required for activation and operation of a shipyard. Hence recruitment and training will be done over several stages.

[19]LOB and Milestone methods are a few of many scheduling techniques.

[20]Graphical Evaluation and Review Technique (GERT) and Computerized Scheduling Technique (SKED) are a few other scheduling techniques.

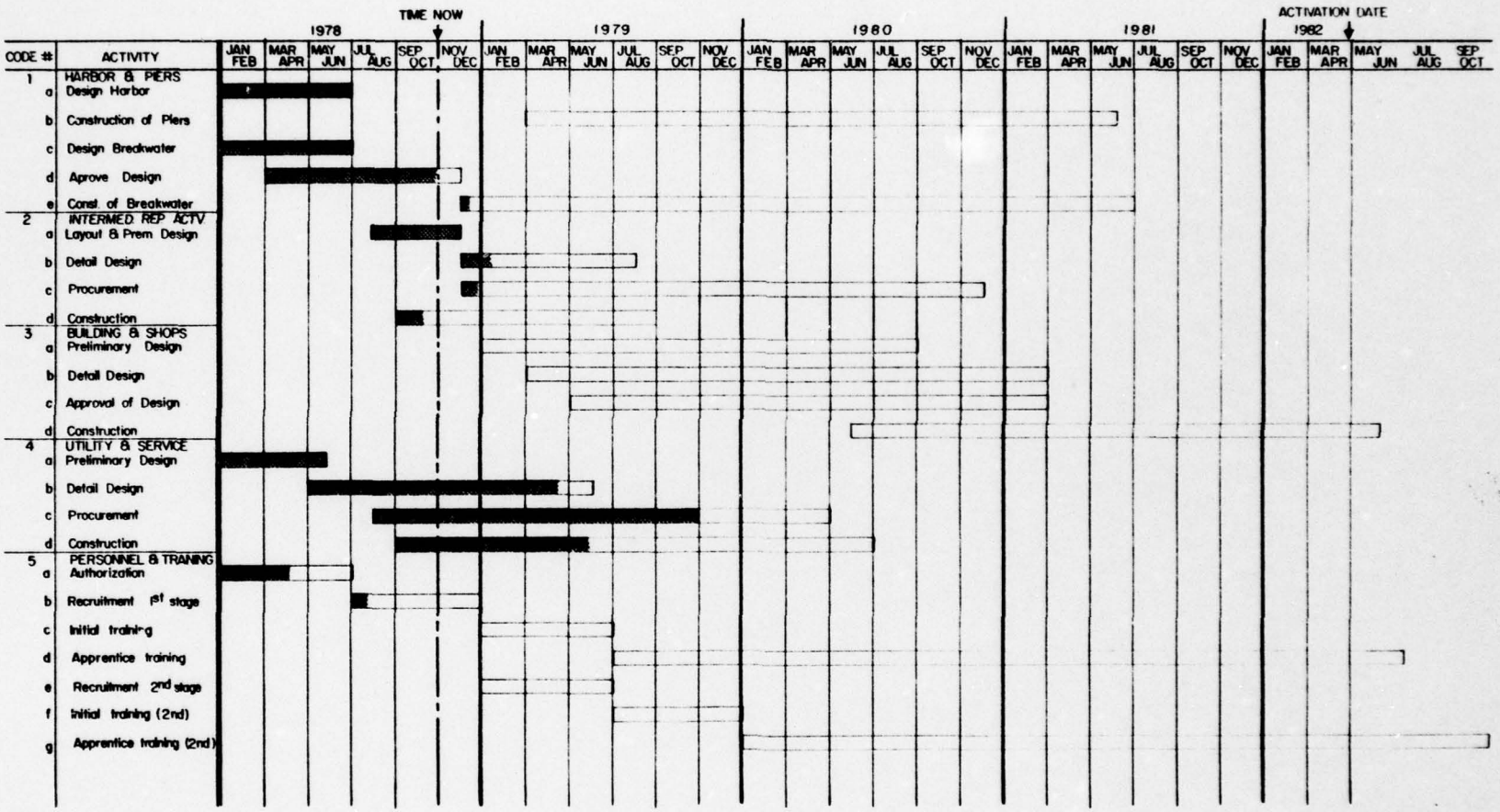

Figure 13. Scheduling Example

was faced with the challenge of producing the Polaris Missile system in record time. The Special Projects Office of the U. S. Navy, Lockheed Aircraft Corporation (prime contractor for Polaris), and the consulting firm of Booz-Allen and Hamilton developed a new method to coordinate that program.

> "The application of PERT on the Polaris project was credited with the successful coordination of 250 prime contractors, over 9000 subcontractors, numerous agencies, and literally hundreds of thousands of individuals. The Navy Department credited PERT with bringing the Polaris missile submarine to combat readiness <u>two full years</u> ahead of schedule" [30:405].

Critical Path Method (CPM) was developed by a joint effort initiated in 1957 by the DuPont Company and Remington Rand Univac. "The objective of the CPM research team was to determine how best to reduce the time required to perform routine plant overhaul, maintenance and construction work" [31:6]. The primary interest was in determining the optimum trade-off of project duration and total project cost. Although CPM initially was used to plan for and control the construction of facilities, it applies equally well to activation of a shipyard, development of a naval base or construction of ships. It is designed to interrelate diverse activities and explicitly depict important interdependencies. PERT and CPM network are fundamental methods of project management. They facilitate the basic functions of planning, scheduling, and control. PERT and CPM provide management with a clear definition of time, cost and resource requirements, an operational network that relates all activities in a time dimension; and a method for pinpointing

critical and subcritical activities. They provide management with a tool to isolate and minimize potential trouble areas; and to reduce bottlenecks, interruptions, conflicts, and delays. They provide a systematic means for better coordinating and synchronizing of the component parts of a large program such as "activation of a shipyard".

a. Project Network

The project network concept has dveloped in an evolutionary way over many years. The network diagram is essentially an outgrowth of the Bar Chart. The project network is designed to correct the deficiencies of the Bar Chart. Its important features are:

(1) The dependencies of the activities upon each other are noted explicitly, and

(2) More detailed definition of activities is made.

The project/program manager decides on the precedence relationship among the activities as soon as he has identified all of the activities making up the project. Generally, "this is not an easy task, because precedence relationships must be based on LOGIC and not on desired precedence" [31 :7].

b. Network Construction

PERT and CPM have similar framework and utilize a network approach. An important element of PERT and CPM is the development of a network or flow diagram that embraces all activities and events and explicitly recognizes major known interdependencies among activities. An activity

is an effort which requires time and resources, such as construction of harbor and piers in the simple scheduling event, Section D-2. The activity is represented by an arrow ⟶ . An event is a specific accomplishment at a recognized point in time (a milestone or checkpoint), such as completion of pier construction. An event is represented by a circle, (2) normally numbered for identification. The network is formed by analyzing the project and breaking it down into specific activities and events. For example for the activation of the shipyard, assume that we initially need 500 men to be trained in two stages. The first group has to stand-by and witness the tests and trials of equipment during turning-over, while the second group completes its training to coincide with the activation date. Here the first level network may consist of the following activities, with precedence and duration as indicated below:

Activities	Preceded	Duration Estimate (Months)
a. Prepare initial organization and personnel requirement for authorization (1)	-	2
b. Obtain initial authorization for recruitment and training (2)	a	2
c. Recruit first group (200 men)	b	4
d. Hire instructors for tec. school (3)	b	8
e. Establish technical school	b	6
f. Prepare training program (5)	d	4
g. Training of 1st group (6)	c,e,f	36
h. Complete construction of yard	-	48

i.	Recruit 2nd group (300 men)	c	3
j.	Train 2nd group	i	36
k.	Test, trial and take-over period (7)	h,g	6

Figure 14 shows the construction of a simple PERT network presented in the above table.

c. Critical Path

The critical path consists of those activities which cannot slip (be delayed) in duration or start-time without delaying overall project completion. In our simple example the critical path is indicated with a double line on the PERT network diagram, (Figure 14). It shows that the completion of the total program will take 58 weeks and it is critical along the path a, b, d, f, g, and k which is: (1) the preparation of initial organization for authorization, (2) obtaining authorization for recruitment, (3) hiring instructors for tech. school, (5) preparing training program, (6) the actual training of 1st group, and (7) the test and trial period of equipment prior to activation. It also shows that the construction period (h) recruitment and training of the 2nd group (i,j) are not on the critical path. In fact there are four and eleven months of slack along those paths respectively. The slack path indicates the activities that allow delays (up to the amount of slack) without lengthening the duration of the project. If the activation date needs to be brought forward, it may be possible to complete the program earlier at some additional cost by compressing one or more activities on the critical path.

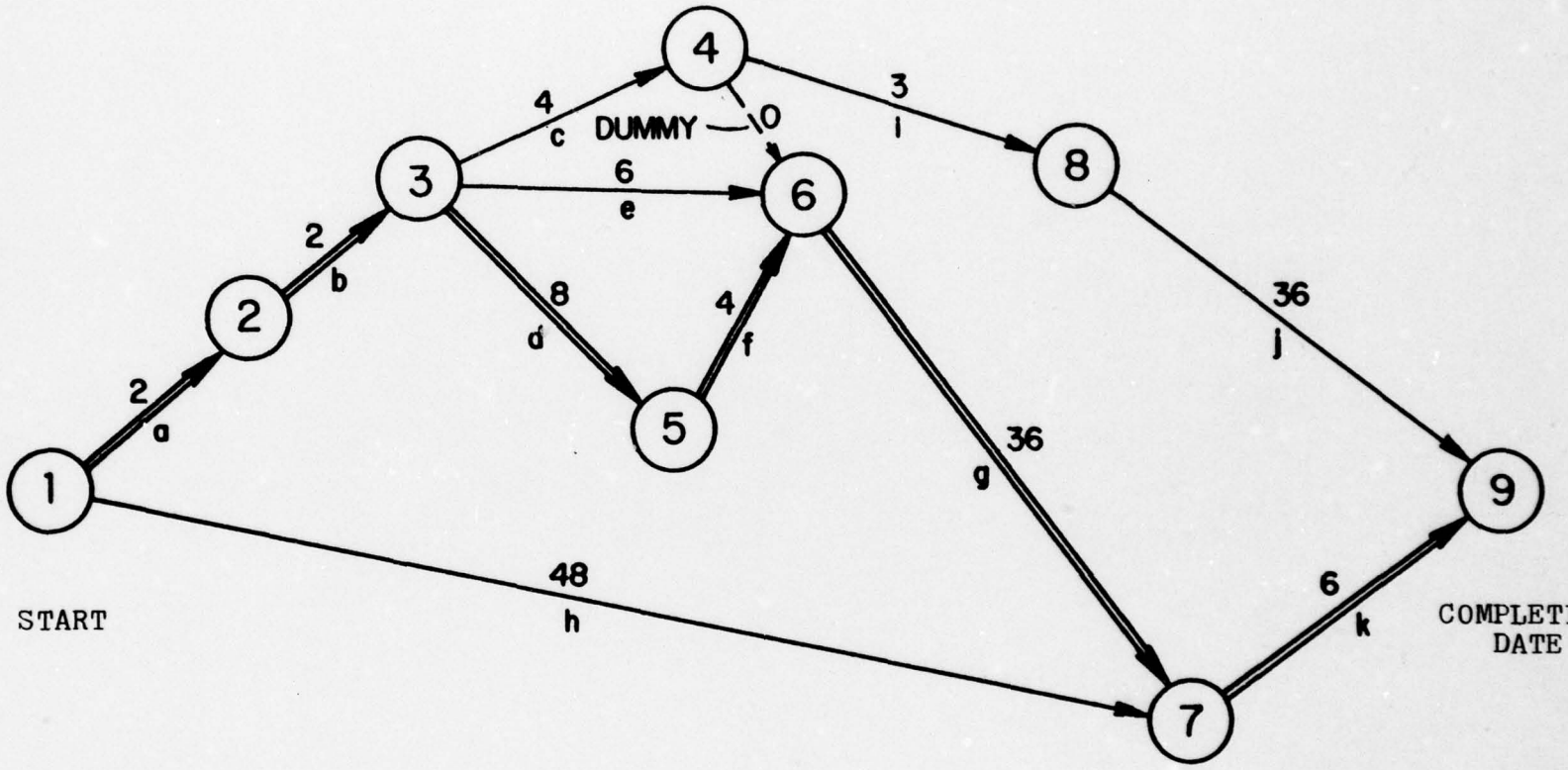

Figure 14. PERT Network

d. Time Cost Relationship

Time-cost tradeoff analyses are available in the literature. If the time-cost relationship of each project activity is known, or can be assumed, then it is possible to determine the minimum additional cost required to reduce project duration by a specified time. The construction and cost analysis of a detailed network for a major program can be much more complicated. The use of a computer is necessary for complex scheduling problems. It is not intended in this thesis to explain the mathematics and complexity of the network.[21] However, in the development and activation of a shipyard, construction of a new ship or the design and implementation of a strategic national defense system, PERT and CPM are the fundamental models of planning, scheduling, and control. They relate individual efforts to a total program requirement, and facilitate communication, coordination, and cooperation of diverse program team efforts.

> By their reporting of favorable and unfavorable developments, PERT and CPM keep management informed as to where they are and where they need to be. They facilitate a smoothly coordinated, on-time completion of often vastly complex one-time projects [30:406].

Having developed the strategy for a program, incorporated that strategy into an overall activation plan and schedule, it is then essential that some means exists to insure that the actual performance meets the planned performance.

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[21]The reader is referred to Moder, Joseph J. and Phillips, Cecil R.: Project Management with CPM and PERT, Van Nostrand Reinhold Co., 1970.

E. PROJECT CONTROL

Controlling a major project is a significant and difficult problem. Project complexity, contract type, military urgency, and the capability and cooperation of suppliers, all affect the degree and type of control necessary. However, a proper means of controlling and monitoring the progress and cost of a project is vital for the successful completion of any project task regardless of the internal and external environment of the program. In this section the control characteristics (i.e., interdependencies of time, cost and performance) will be discussed.

1. Background and Characteristics

As projects have become more complex and costly, the need for control has increased greatly. The cost and political implications of poorly controlled projects has caused us to pay much more attention to the issue of control. The procurement of the F-111 aircraft for the U. S. Department of Defense (DOD) in the late 1960's was an unpleasant experience. The contract was originally for $2.8 million per aircraft, but the ultimate cost was $14.7 million per unit. Even though the ultimate cost was several times higher than the initial estimates; performance, reliability, and growth potential of the aircraft were well below contract specifications. Obviously the overall acquisition project was a major disappointment. "The long term effect of this massive cost overrun was that only 519 aircraft (F-111) were obtained, vice the 1,726 units that were planned" [32:10].

It is appropriate here to define the control system and see why it is essential. The control system generally will encompass all three parameters of project schedule, cost and performance.

Robert N. Anthony[22] states that "...control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" [33:17]. The definition of project control is intended to convey three key ideas: (1) the process involves the use of various managerial tools, (2) the control process takes place within the context of the objectives, policies, and contractual arrangements that have been determined within the strategic planning process, (3) the control must be exercised to provide for efficiency and effectiveness as close to an optimal conduct as possible [33:17]. But in regards to the Government agencies and military organizations, Charles J. Hitch[23] has pointedly observed that "...there is within government neither a price mechanism which points the way to greater efficiency, nor competitive forces which induce government units to carry out each functions at minimum cost" [34:105].

Many of these distortions of natural economic forces are a result of the environment in which the agency must operate. Often there exists only a sole supplier for a

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[22]Anthony, Robert N., Former U. S. Department of Defense Comptroller, reference 33.

[23]Hitch, Charles J., another former U. S. Department of Defense Comptroller.

sophisticated system, or the tactual situation dictates an extreme urgency for the completion of a project. The end result is that to ensure effective and efficient conduct of any major project, the customer must involve himself in the detailed management and control of its suppliers. Note that the suppliers may be contractors, other departments of the Service, or other agencies of the Government.

a. The Controlling Authority

The degree of control which the project manager must exercise over the contractor will vary with the type of contractual arrangement. A project which is conducted under a firm fixed-price contract generally involves low risk and will require less control. Here the contractor accepts the risk and management responsibility. As the risk of a project is escalated[24], or specification changes are negotiated, the managerial responsibility shifts more and more to the customer (i.e., the Navy Dept.). However, the undeniable truth is that the project managers need to maintain some form of control over their projects regardless of the type of contract that is negotiated.

b. Qualities of Control System

The type of control system is determined by the nature of the project and by the ability of the participants to administer it. For example a simple project may require only a few control techniques to determine if cost, time and schedule are being met. But, a major program such as

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[24] i.e. Many unique uncertainties exist in the special environmental condition of the Persian Gulf region.

"the activation of a shipyard" requires sophisticated and extensive control techniques. Regardless of the magnitude of the project, the following criteria must exist in order to have a workable control system: (1) The control system must be clearly understood by those who use it. Both the customer and contractor must understand the interfaces and scope of the control procedures. This understanding may significantly affect the accuracy of inputs, standards, and analysis. (2) The control system should be primarily predictive in nature. It must anticipate deviations and indicate the nature of the problem. The control system should report project deviations on a timely basis in order to ensure that corrective actions can be taken in time. (3) The control system must be economically efficient. The additional cost of the control system must not exceed the possible savings. These qualities are present in varying degrees in all control systems and generally reflect the non-routine and uncertain nature of the project environment. The project manager depends heavily on the control system and frequently may be involved in determining the scope and objective of that system. He will have to choose among many alternatives in order to allow for optimal resource utilization. "How effectively he does this determines whether he will control the project or the project will control him"! [26:43].

c. Functioning of the Control System

The key element in effective project control is information; the right information at the right time. The major questions in developing a control system are what data is required and how is it to be obtained. The next phase is to evaluate the actual performance with the plan; that is the comparison of the accomplishments with standards. Finally the control system should initiate corrective action to bring the planned and actual together. However, major programs require more of a control system just the collecting of data. The control system must reveal the interrelationship and criticality of project deviations. The detail of information required varies inversely with the functional level of the individual. For example, a broad level of program status is required by the C-in-C or the ministry of defense (e.g. the program cost and schedule), as opposed to the detail of project status required by a sub-project manager (i.e., the reliability and maintainability of a certain machine in the shop). The control system ultimately is a personalized activity, a complex system that is dependent on the knowledge, ability, and motivation of the people in the organization [19:330]. The control system operates through people who must understand the objectives of the control mechanism, as well as the requirements for human interaction.

However, more often, a successful project manager not only possesses a sophisticated control system, but also

he is able to utilize that system effectively and with proper consideration for the requirements of individuals and group behavior.

2. Techniques of Performance Control

In economic terms, performance is an appraisal of the results of an activity's behavior as compared with some "standard" which has been determined by considering the optimum utilization of resources to achieve the activity's goals [5:114]. Quantifiable "standards" of performance in most government activities are few. More frequently, subjectivity must be applied in order to provide some means of assessing performance. Further, the one-time nature of most government projects gives the project manager little historical reference for such value judgements on performance. Yet it appears that the current trend is indeed an increased emphasis on monitoring project quality and performance.

The success of major projects depends on how successfully the system meets the requirements specified. Typically such requirements will be stated in terms of performance. Hence the control of project performance has become the critical measure of success and numerous techniques have been utilized to effectively provide this control.

Application of an individual technique depends upon the nature of the project, the life span, the size, the level of uncertainty, and criticality of the project.

F. MANAGEMENT INFORMATION SYSTEMS (M.I.S.)

The term "Management Information Systems" implies a formalized capability for generating information useful in managing the organization's major functions. Technological advances in automated data processing equipment have had great impact on the development of Management Information Systems. Processing and storage costs have dropped considerably and processing speeds increased enormously. Hence, it has become economical to store, manipulate and process large amounts of data to produce useful information in timely fashion for management decision making.

1. Definition of M.I.S.

Management Information Systems has been defined as a system that provides the management (decision-makers) within an organization with information that reduces the degree of uncertainty in the decision making process. Management Information Systems is also defined more comprehensively by Davis[25] as "an integrated, man/machine system for providing information to support the operations, management, and decision making functions in an organization. The system utilizes computer hardware and software, manual procedures, management and decision models, and a data base" [35:5]. The M.I.S. concept extends the function of the information system well beyond the operational level to a system for providing information resources in support of the management

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[25]Davis, Gordon B. is the author of the book, Management Information Systems, reference 35.

decision and planning area. It is important to realize that the management information system is related to people and it should meet the needs of the managers.

2. The Need for M.I.S.

Effective planning and controlling in any organization requires relevant information. "The quality of decision depends greatly on an understanding of the circumstances surrounding an issue and knowledge of the available alternatives, states of nature and competitive strategies" [36:365]. The better the information, the better the resulting decisions should be. Organizations cannot rely on the memory of the people who manage them, because individuals come and go (due to changes and turnover).

Therefore organizations must, out of necessity, develop some type of information system to manage existing information as well as to utilize the vast data-generating capacity of the computer.

Application of M.I.S.

Modern organizations whether a program office, a shipyard, or a sugar beet plant, consist of inter-related departments and units. For decision-making purposes, management must depend upon various sources of information, both external and internal to the organization. This has become especially necessary as organizations grow in size and complexity. Management information systems are designed to provide information to managers to support their decision-making process. The amount of information which must be on

hand to support management today, even for a modest organization, is quite phenomenal. Effective information processing for managerial decision-making is vital to the organizational success. Both the program management and the shipyard operation management are highly dependent on the M.I.S.

a. Program Management

The M.I.S. brings to management an orderly, understandable compilation of information necessary to make decisions. Its greatest asset is that it can manipulate extremely large amounts of data efficiently and in a relatively short time span. It produces periodic reports, PERT/CPM and other managerial products used by management.

b. Naval Shipyards

The design of a management information system to serve the needs of a large industrial complex must be dynamic and must be managed by users (not data processing personnel). The MIS provides an effective information system to support the repair and modernization of vessels in the naval shipyards. The Management Information System in the U.S. Naval Shipyards is called the "Shipyard MIS" for short. It is an integrated, and computerized system which takes into consideration all aspects of industrial management such as: forecasting, planning, scheduling, production, evaluation and controlling, etc. The system was developed by Naval Sea Systems Command and is continually modified to

produce reports used by a broad spectrum of system users. The shipyard M.I.S. is presently organized into four basic subsystems which in turn subdivide into many different applications by management functional category [7:54]:

(1) Industrial management consisting of: workload, forecasting, design, production control, scheduling, performance measurement.

(2) Material management consisting of: industrial material, shop stores, etc.

(3) Financial management consisting of: costs, budgets, payrolls, accounts payables.

(4) Miscellaneous including radiation exposure control, personnel management, etc.

There is considerable opportunity for improving the shipyard MIS to increase its potential for assisting shipyard personnel in maintaining the fleet in a more cost effective manner.

In this chapter we have reviewed different possible approaches to the management organization required for a program as complex as the activation of a naval shipyard. The matrix organizational approach appears to be the most appropriate one. We briefly have described the functions of planning, scheduling, control and management information systems as they apply to such a program.

It is now appropriate to consider several detailed recommendations dealing with the activation program. This is the subject of Chapter VI.

VI. ACTIVATION PROGRAM

A. INTRODUCTION

The "activation program" for a naval shipyard (described in the previous chapters) is the overall process of planning, scheduling, coordinating, controlling of the many projects from their inception to their completion. This planning process is a complex and multifaceted program. It requires the design of a systematic method of anticipating future conditions and coordinating the employment of resources in a manner which enhances achievement of established goals and objectives. It involves not only the coordination of many departments within the Navy organization (Personnel and Training, Civil Engeering, Logistics, and Technical Directors, etc.) but also many other defense organizations (Army, Air Force, Coast Guard), government ministries (Energy, Labor, Education, Road and Transportation, and Communication), and contractors. This program is a collection of non-repetitive projects, which are generally viewed as being one-time efforts. The operation of each project is a fairly involved mixture of series and parallel activities, and must have a significant interplay of human skills, as well as other resources such as material and facilities. The duration of the overall program could take years. In fact, it is probably the sum of the durations for the longest projects which are in series. It is recognized

that during this long-range program many changes, uncertainties and external activities will occur. Changes press the organization from forces outside as well as inside. Environmental (economic, social, political, and technological) trends must be noted and their influences incorporated into policies and practices. This thesis does not provide the solution to these complex problems. Rather, it identifies some of the key tasks for this program. As stated in Chapter I, the nature of the problem is "activation of a naval shipyard". This encompasses a major planning and coordination effort of many individuals, departments and agencies. In regard to the history of planning in Iran, Harold Mehner[26] states that "this is an exciting chapter in Iranian national development". Initiative was taken in 1939 to draw-up a planning memorandum which postulated the necessity for an economic plan and the establishment of a planning center for Iran. Better use of the country's limited economic resources, the establishment of priorities, and a program of economic coordination were recommended [37:167]. But the planning memorandum alone did not solve all the problems. It certainly called for proper implementation, direction, integration of men and material, and coordination and control of all the necessary activities to see the result of a successful planning. Mehner cited an example of the lack of planning and coordination:

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[26]Author of Development and Planning in Iran after World War II, reference 37.

"Several public sugar-beet factories were constructed and started production without qualified supervision--supervision that could also have promoted seed production and successful methods of cultivation, regulated prices, and solved other problems related to the new program. Almost forty years later, some aspects of this program were still waiting for an optimal solution" [37:168].

The importance of personnel training and retention for an industrial organization in the Persian Gulf area becomes much more evident when the historical and the social background of the area, and also the magnitude of the problem for starting, building-up and operation of the shipyard (discussed in Chapter 2) is recognized.

The activation process of this naval shipyard must incorporate well planned, gradual and prioritized steps for more key tasks. For example, one need not get overly concerned from the beginning about the Commissioning Ceremony[27], while more important tasks such as training are yet in their stage of infancy. Any delay in recruitment and training tasks could have undesirable consequences upon all other major activities.

The overall activation program consists of the two major groups of projects as tabulated below:

1) Construction and Support Group	2) Shipyard Activation Group
a) Housing and community facilities	a) Personnel: recruitment and training
b) Industrial utility support (electrical power and water, etc.)	b) Supply support: raw materials, spare parts, office equipments, etc.

[27]The Commisioning or Activation Ceremony is the day when construction and all other preparation is completed and a ceremony is held for the official opening.

c) Land routes and railroads	c) Transportation and handling
d) General communication (Post, Telephone & Telegraph)	d) Test and support equipment
e) The shipyard, port facilities, docks, and other support facilities	e) Technical data and M.I.S.
f) Community transportation	f) Maintenance planning

It is important to realize that some of the major tasks in the construction groups are outside the Navy and D.O.D.'s authority. For example, the utility support 1(b), land routes and railraods 1(c), and communication 1(d) are the responsibility of the Energy Ministry, Roads and Transportation Ministry, and Communication Ministry (P.T.T.), respectively. The management of all these different but interrelated projects requires establishing a strong and centralized program office, which would be responsible for the coordination, direction and control of the total program.

MAJOR TASKS

Some of the major activities related to the responsible functional departments/agencies are:

1. Personnel and Training (2a)

Personnel, recruitment and training are generally the responsibilities of the Director of Personnel (Navy). The actual training shall be performed by the Navy Training Centers and Technical/Vocational schools of the Navy. However, due to the magnitude of the task, the assistance and coordination of other government agencies (Education and Labor Ministries) and also commercial institutions must be obtained.

2. Construction of Facilities (1a and 1e)

The Civil Engineering Director (Navy) shall generally be responsible for all construction work, which is normally contracted.

The following are the kinds of buildings and facilities the CED would be responsible for:

a. Industrial area; shops, offices, jetties, drydocks, warehouses, dispensary, rest and recreation facilities, etc.

b. Community area; family housing, BOQs, BEQs, schools, health clinics, recreation facilities (e.g., clubs, libraries, sport stadiums, swimming pools, etc.), mosque, markets, etc.

3. Test Equipment and Supply Support (2b and 2d)

This area shall generally be the responsibility of the Director of Logistics (Navy). It includes all the responsibilities for those items of test and support equipment and the supply support explained in Chapter IV.

4. Utility Support (1b)

Utility support is generally broken into two areas:

(a) The main electrical power supply and the fresh water system with its distribution throughout the base and community. These areas shall be the responsibility of the Energy Ministry and its local department within the province.

(b) The alternative or emergency electrical power supply and distilled water distribution systems, throughout the base and the industrial area shall be the responsibility of the Civil Engineering Director (Navy).

5. Roads and Railroads (1c and 1f)

Land routes are separated into two areas:

(a) The roads and access routes (land and railroads) in the local communities and towns, and roads and access roads linking them to other cities and industrial centers in the country, shall be the responsibility of the Road and Transportation Ministry.

(b) The roads within the confines of the industrial facilities and Navy community shall be the responsibility of the Civil Engineering Director.

6. Transportation and Handling (2c)

Transportation and handling (an element of I.L.S. as described in Chapter IV) for the shipyard shall be the responsibility of the Director of Logistics.

7. General Communication (1d)

The general communication here may be divided into two parts:

(a) External Communications which include Telephone, Telex, Telegram systems, etc. as links between the base and other cities, and military establishments shall be the responsibility of the Communication (PTT) Ministry.

(b) Internal Communication (Telephone, intercomm, etc.) within and between the shipyard and the naval base which shall be the responsibility of the C.E.D. with the assistance and input from Director of Operation and Technical Director.

8. Shipyard Operational Requirements (2d and 2f)

Preparation of shipyard organizational structures, management policies, technical data, maintenance planning, and the Management Information Systems suitable for the operation of the naval shipyard, should normally be the responsibilities of the Technical Director (Navy).

In this chapter, the concepts and organizational structure of the program office are now described. Special attention is devoted to the overall management of the program and the total coordination of all activities.

B. PROGRAM OFFICE

Mr. John William Vice President of Ingalls Shipbuilding Division of Litton Industries, stated that for a program of $450 million lasting 4 1/2 years (the construction of Ingalls Shipbuilding, Pascagula, Mississippi) the Program Office required a staff of more than 23 persons. This staff included managers, system analysts, planning specialists, budget analysts, and system engineers, etc. More than $1.0 million was funded specifically for the Program Office, constituting more than 0.22$ of the total program cost [38].

The Trident[28] System Project Office has 55 personnel on the staff at its headquarters in Washington, D.C. There are many additional personnel required for direct supervision and control at the support site, Bangor, Washington.

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[28]Development program, Trident Polaris Submarine Base, Bangor, Washington (see reference 39).

During a research visit to Bechtel International[29] of San Francisco it was interesting to learn that this organization, involved in a fairly similar project in the Persian Gulf area, employed about 400 designers and 200 management consultants. More than a year ago, Bechtel established a separate activation program office, employing approximately 22 planners who are solely responsible for the activation of the program, some five years off.

These examples are presented to indicate the size and personnel requirements of a few fairly comparable projects. It can be appreciated that the activation of the shipyard (as described in Chapter 2) will include far more than just the construction of buildings and shops. It is a great deal more than just the construction of a naval base, for it is these projects plus the development of a town and all of its community facilities. The completion of such a large-scale program in an isolated, and remote region requires the consistent and dedicated efforts of many government agencies, military departments, industries, contractors and the personal dedication of individuals. Coordination of all agencies, resources and activities is the key factor for the success of any program. Good control result in coordinated activities.

Management relationships will become very complex requiring someone to be in overall control of the situation

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[29]Mr. William Walton, Manager Construction Division, Bechtel International, 45 Fremont Street, San Francisco, July 1978.

lest vast amounts of resources are uselessly exhausted. The necessity of an operational shipyard is critical for the readiness of the fleet. Hence the need for a management group, which can cut across traditional functional lines, to bring together resources required to achieve the program's goals, is clear [18:18]. This Program Office may be established by the order of the Commander-in-Chief (C-in-C) of the Navy, to be responsible to him or the Director of Logistics, for the overall management and direction of resources assigned to the shipyard program.

The objective is to strengthen management's authority in order to ensure the development of the shipyard activation program, to achieve the capabilities required with the approved schedule, the budget and other resources made available in accordance with the overall Navy policies.

In the following paragraphs the Program Office organization, staff, the general functions and the program coordinators will be discussed.

1. Program Office Organization

The concepts of three different project organizations: functional, project and matrix were presented and discussed in Chapter V, Section B-1. No single perfect or ideal organizational structure for managing all programs exists. The functional, the project, and the different matrix structures all have strengths and weaknesses. The final choice should come after weighing various factors: the nature of the task, the needs of the organization, the

environment of the program, and the cultural and social behavior of those who are going to operate it. To properly manage such a complex program, an organizational structure should be set up, to be able to plan, direct, coordinate and control all the tasks involved to meet the stated objectives. Considering the complexity of the task and the constraints for qualified personnel, a matrix form of organization (as described in Chapter V, Section B-1) is probably the most suitable for this program office structure. Figure 15 shows a multi-matrix organizational structure that the author proposes for this program office. It consists of:

(a) An internal matrix pattern within the program office. That is the interaction between the Director of Plans and Programs, and the Director of Program Requirements, and Director of Integrated Logistics Support (ILS) and other managers.

(b) An external (first) organizational format between the Program Office Directors and the Navy's traditional functional departments (Directors of: personnel, logistics, plans and budgets, operation, and civil engineering, and technical directors) also is on a matrix approach.

(c) An external (second) pattern of interactions exists between the Director of Plans and Programs, Director of Program Requirements and Director of ILS with other ministries (Energy, Roads and Transportation, Labor and Communications) and other government agencies.

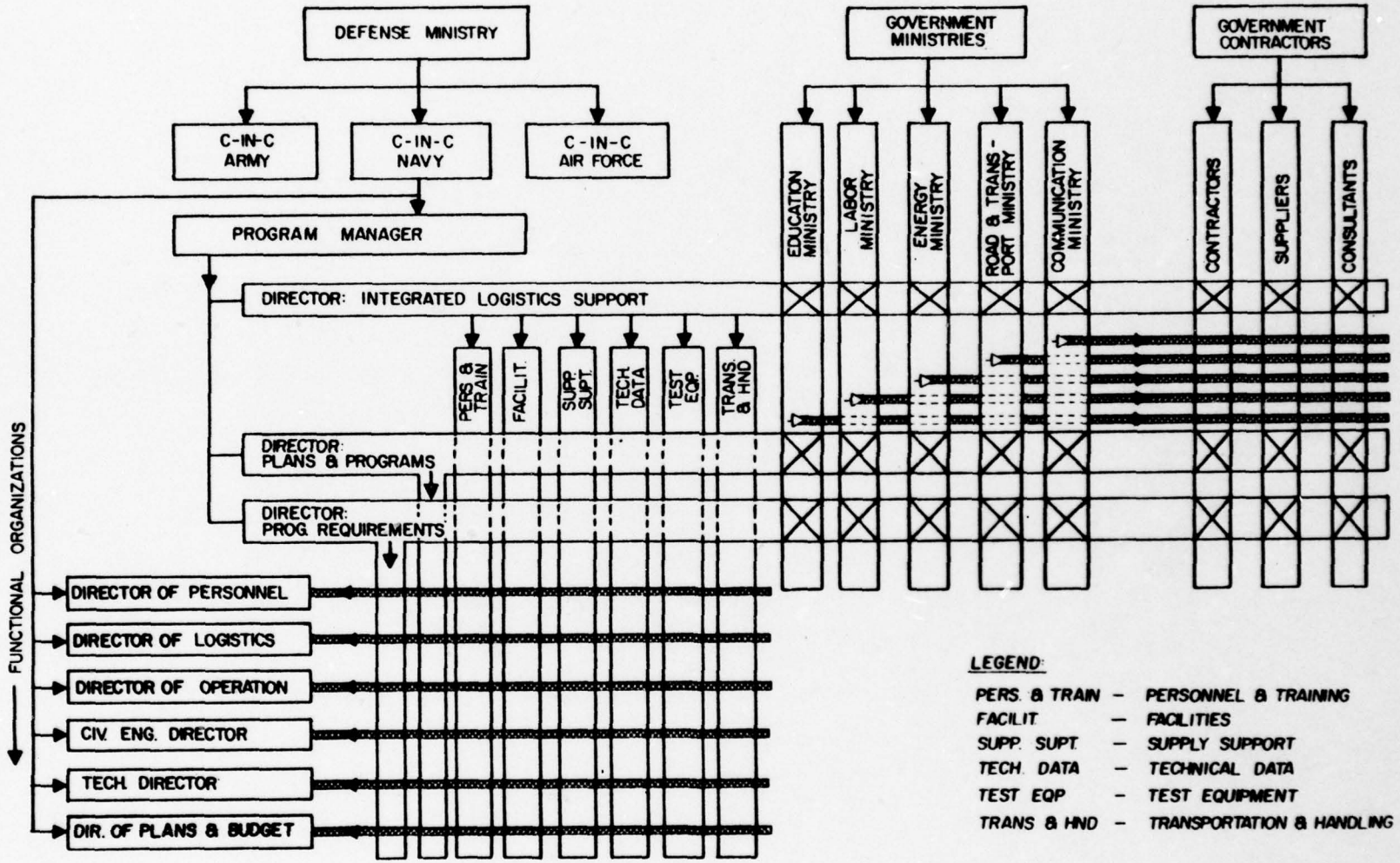

Figure 15. Program Office Multi-Matrix Organization

(d) Yet a third external structural interaction between the Program Directors and Government Ministries with the many contractors, consultants and suppliers. Fiugre 16 identifies the accountability and responsibility of management in this matrix organization for representative functions and tasks. This matrix accountability and responsibility chart "shows who participates, and to what degree, when an activity is performed or a decision is made. It shows the extent or type of authority exercised by each executive/manager in performing an activity in which two or more executives have overlapping authority and responsibility. It clarifies the authority relationships that arise when executives share common work" [19:197].

It is recognized that a major program organization must change as the program matures. That is, major changes occur in the transition phases from conceptual-development/definition, to construction/acquisition-operation, and divestment phase. These changes require staff changes in numbers, skills and organizational structure to accomplish the activation program responsibilities (see Figure 6 Chapter IV)

2. Program Office Staff

The program office requires a full time program manager and sufficient staff to handle a program of such magnitude. The personnel should consist of qualified and experienced management oriented mixes of generalists and

TASKS \ POSITIONS	GOVERNMENT LEVEL													NAVY LEVEL															
	CHIEF EXECUTIVE / PRESIDENT	DEFENSE MINISTRY	C-IN-C	PROGRAM MANAGER	EDUCATION MINISTRY	LABOR MINISTRY	ROAD & TRANS. MINISTRY	COMMUNICATION MINISTRY	ENERGY MINISTRY	GOVERNMENT: CONSULTANTS	GOVERNMENT: CONTRACTORS	GOVERNMENT: SUPPLIERS	DEFENSE MINISTRY	C-IN-C	DIRECTOR OF LOGISTICS	DIRECTOR OF PERSONNEL	DIRECTOR OF PLANS & BUDGET	DIRECTOR OF OPERATION	CIVIL ENG. DIRECTOR	TECHNICAL DIRECTOR	PROGRAM OFFICE: PROGRAM MANAGER	PROGRAM OFFICE: DIRECTOR: PLANS AND PROGRAMS	PROGRAM OFFICE: DIRECTOR: PROGRAM REQ.	PROGRAM OFFICE: DIRECTOR I.L.S.	NAVY: CONSULTANTS	NAVY: CONTRACTORS	NAVY: SUPPLIERS
ESTABLISH POLICIES AND OBJECTIVES	2	1	①	3	4	4	4	4	4	4			2	1	3	3	3	3	3	3	①	3	3	3	4		
OVERALL DIRECTION PLANNING & CONTROL	2	6	1	3	4	4	4	4	4	6	6	6		2	3	3	3	3	3	3	1	3	3	3	4	6	6
PERSONNEL AND TRAINING	2		4	3	1	4				4				6	3	①	3	4	4	3	1	3	3	3	4	5	
CONSTRUCTION OF FACILITIES		2	1	3	6	4	5	5	4					6	3	5	4	6	1	4	2	3	3	3	4	①	6
TEST EQUIPMENT & SUPPLY SUPPORT				3				6							1	6	4		5	4	2	3	3	3	4		①
UTILITY-MAIN SUPPLY	2	6		3	6	6	6	6	1	4	①	6		6	6				3	4	2	3	3	3	4		
UTILITY-ALTERNATIVE				3					3						6		4	6	3	3	2	3	3	3	4	①	6
ROADS - TOWN & R.R. COMMUNITY	2	6		3		4	1	5	5	4	①	6		6	6				3		2	3	3	3	4		
ROADS & R.R. - NAVAL BASE			6	2		6	4							6	4				3		2	3	3	3	4	①	6
TRANSPORTATION & HANDLING														6	1	6	4	6	4	4	2	3	3	3	4	4	6
GENERAL EXTERNAL COMM.	2	4	6	3			4	1	5	4	①			6	6			4	5		2	3	3	3	4		
GENERAL INTERNAL COMM.		2	1	3				4						6	6	6	4	6	1	4	2	3	3	3	4	6	①
SHIPYARD OPERATIONAL REQ.		2	1	3	4	4								3	3	3	4	4	4	1	2	3	3	3	4	①	①

① ACTUALLY PERFORMING 1. ACTUAL RESPONSIBILITY 2. GENERAL COORDINATION & SUPERVISION
3. MUST BE CONSULTED 4. MAY BE CONSULTED 5. MUST BE NOTIFIED 6. MAY BE NOTIFIED

Figure 16. Matrix Authority-Responsibility Chart (MARC)

specialists. A proposed program office staff is presented in the Organization Chart, Figure 17. The total recommended staff for this program is 56 personnel. The key immediate subordinates to the program manager are: (1) Executive Assistant, (2) Director of Plans and Programs, (3) Director of Program Requirements, and (4) Director of I.L.S. The program office staffs are the unifying agents who coordinate and integrate the interests of various independent organizations towards a common goal. The senior staff, especially, should be comprised of well experience management-oriented individuals who would get involved personally in the planning aspects of the program and not rely on planning staffs or the specialist planners. They may consist of experienced managers, system analysts, cost analysts, schedule analysts, system engineers, program controllers, organizational development specialists, community specialists, etc. There would also be I.L.S. specialists and analysts in the fields of personnel and training, facility construction, supply and procurement, transportation and handling, test and support equipment, technical data and management information systems. It is realized that sufficient qualified talent and specialists may not be available at the required time within the Navy organization. Hence full use should be made of experienced personnel and specialists from other ministries/agencies, contractors and management consultant services.

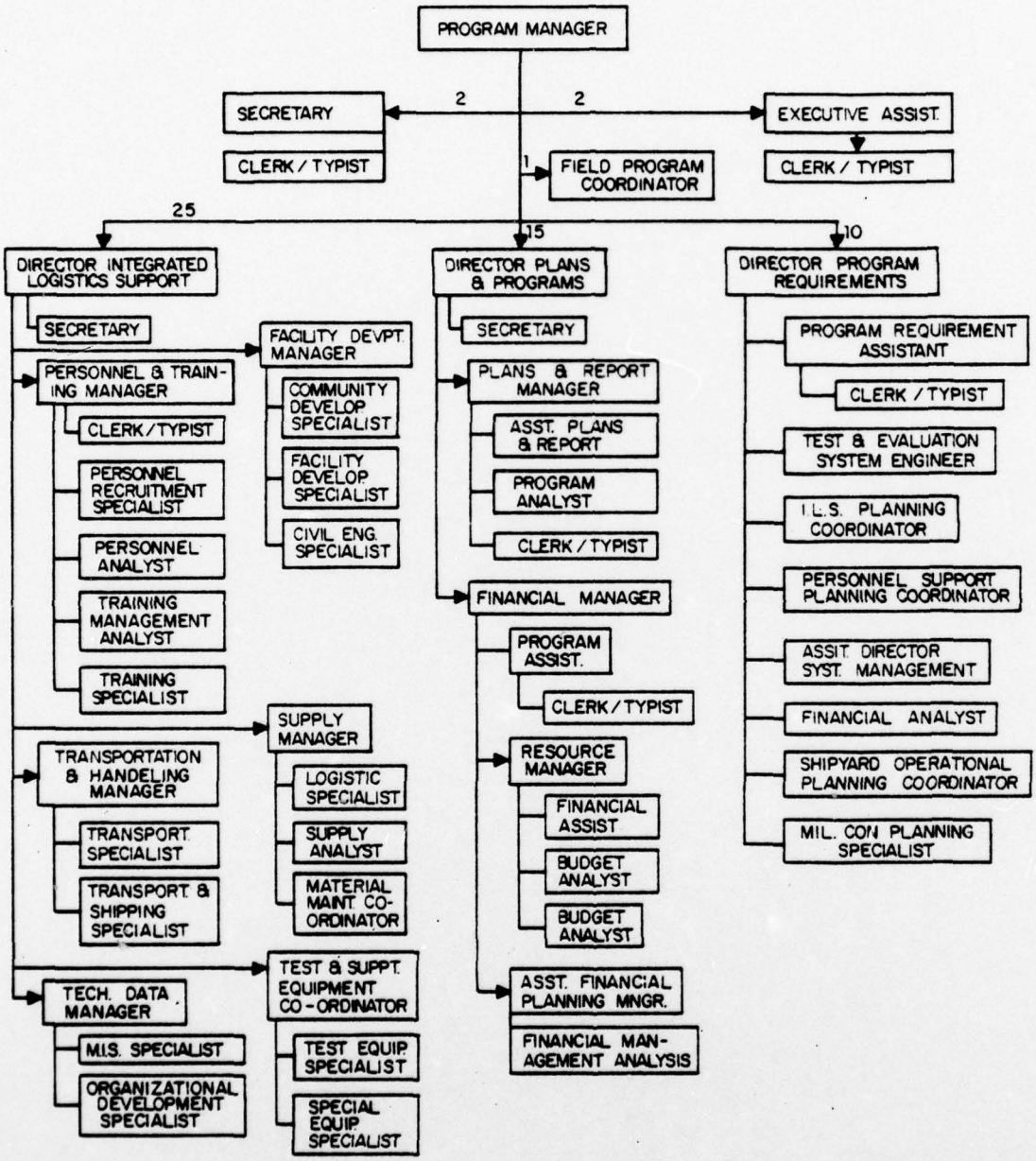

Figure 17. Program Office Staff
Staff Organization

3. Program Manager (P.M.)

Ideally the program manager should be a multidiscipline, experienced manager with sufficient tenure and interest in the program to provide continuity and to accrue personal accountability for his actions [40:10]. The initial responsibility of the program manager is to identify and recruit the staff with the required skills and experience to manage the assigned task. The organization and the management level of the program should be consistent with the scope and importance of the program. The golden rule in matrix management states: "He who has the gold makes the rules". That is, if the program manager does not control the budget, he would not have full control over the program. A matrix budget assigns resources to the program manager for purchases from the functional departments. Making up such a budget takes careful work during long-range and annual planning. Regular up-dating of plans and budgets are essential for the success of the program [41:52].

The program manager (P.M.) is responsible[30] for program management, including planning, direction, control, integration, and coordination of all efforts within the organization. For the program manager to perform his task in a multi-matrix organization as described in the previous section, he must further be prepared to perform the following:

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[30] In United States Navy for the Trident System Project, these policies and responsibilities are established and delineated by SECNAVINST 5000.1 of 13 March 1972 and NAVMATINST 5430.45D "Charter for the Trident Project Manager (PM.2)", reference 39.

a) Identify interfaces between functional departments (e.g., Energy, Roads and Transportation, Labor, and Communication Ministries, and other departments within agencies and the Navy) and program elements.

b) Constantly communicate status of interfaces to all concerned.

c) Monitor, evaluate, and take appropriate actions to ensure the completion of objectives within the interface structure. The general personal traits may be listed as: flexibility, adaptability, leadership, confidence, agressiveness, initiative and forcefulness.

It is important to note that a clear directive regarding the responsibility and authority of the Program Manager must be issued to all organizations concerned with this program. All organizations under the Navy command must maintain close liaison with and be responsible to the program manager for the shipyard activation program.

4. Program Coordinators

Coordinators need to be assigned in all departments of the Navy which have a sizable responsibility in this program. Also, high level coordinators may be appointed in other government agencies. The program coordinators will have a difficult position being responsible to more than one boss at any one time. But the following consideration can help avoid conflict:

a) A clear charter from top management (C-in-C) defining responsibility and authority for the program as

well as the role of the functional departments is absolutely essential.

b) The program manager must anticipate conflict in this kind of multi-role position in the organization. Conflict is inevitable in the matrix organizational structure, but it must be recognized and resolved immediately rather than be ignored.

c) Team-work must be developed. Regular meetings, good communication and regular social gatherings help to foster a team spirit.

d) The program coordinator's main power comes from the approved objectives, plans, and budgets for the program. These documents should be used to hold departments to their commitments.

e) It is important that the functional department heads be committed to the plans and schedules for the program.

f) It is usually best to avoid direct conflict with the functional department personnel. Matrix personnel should use their bosses when a situation threatens to get out of hand.

g) It is important to remember that the program coordinator is concerned with "what" is to be done and not "how". A management-by-objectives approach should be used and unduly close supervision of the functional departments must be avoided.

h) Most problems arise from the unawareness and uncertainty inherent in the program environment. Careful review, effective communications and continuous planning can help clarification and reduce uncertainty [41:53].

Due to the critical nature and complexities associated with recruitment and training of suitable personnel (specialists) to operate the shipyard, it is desirable to discuss personnel considerations in some detail. This in no way detracts from the importance of other tasks. It merely recognizes the extremely difficult nature and need for early action to have qualified technicians available to coincide with acceptance of the shipyard facilities.

C. PERSONNEL AND TRAINING

The term "Personnel" in this section will consist of all human resources employed for the manning and operation of a naval shipyard. They would be the management administrators (military and civilian), engineers, designers, draftsmen, supervisors, planners, tradesmen, clerks, laborers, etc. As discussed in Section B of Chapter 2 there are numerous trade occupations of which the overwhelming portion will be civilian. These men have to be trained for the tasks since a certain amount of specialization will be required to maintain the complex systems and modern weapons of today's Navy ships. This training task, concerning the operation of a new industrial complex, is the most important one that all levels of management will have. Its importance is magnified in the case of rapidly

developing nations where there is a great demand for skilled tradesmen in relation to the available pool of skilled labor. Thus, frequent shortages of trained personnel are felt throughout all of the industries of the country. This problem will become especially acute when there are requirements for these valuable personnel resources to perform highly demanding jobs in the military environments of the Persian Gulf and Oman Sea coastal area.

During research interviews one notable official stated that "a superintendent of a Pakistani Naval Dockyard had said that his yard would normally employ more men than actually required because one never knew who and how many were going to show up the next day". This is an example of the cultural and environmental effects on human behavior in a analogous area regarding "manpower requirements".

Development of manpower requirement for a naval shipyard generally depends on the planned workload capacity for the organization. The workload capacity itself will depend on the numbers and types of ships to be serviced and the nature and magnitude of the repairs to be performed over a given period of time. Allowance must also be given for unscheduled repairs and maintenance and any other non-shipwork tasks inherent in its mission. Determination of manpower requirements would also depend on a set of basic assumptions and planning parameters developed for the specific standards and environmental conditions such as:

1) The standard Navy's operation-overhaul cycles planned and enforced for the assigned ships.

2) The industrial work standards; type of quality assurance performed.

3) The skill level of the work force.

4) Availability of adequate electrical power and water to meet the needs of the shipyard and related support facilities.

5) Availability of industrial support, i.e. messing, housing, medical facilities, etc.

During interviews when the author asked "What is the most important single task for this activation program?" those individuals who had a background in the subject or were acquainted with the region stated "personnel and training".

It is recognized that many of the trade technicians specialized in shipwork electronics (i.e., fire control system, sonar and other naval weapons) are extremely scarce within the country. Table III presents a list of shipyard manning requirements based on the U. S. Navy's experience. It consists of many tradesmen of differing levels (i.e., journeymen, apprentice, helpers) working in 18 different shops. It shows that for an assumed shipyard of 5000 personnel only about 52% (2600 men) are actually working in the various production shops. The other 48% (2400) men consists of supervisors, accountants, storekeepers, planners, estimators, engineers, clerks, and all other administrative personnel. However, the most important aspect of this task is that the great majority of these men have to be fully trained and experienced in the trade required.

TABLE III - SHIPYARD MANNING REQUIREMENTS *

SHOP	TRADE	JOURNEYMAN REQUIRED	JOURNEYMAN PERCENT OF TOTAL MANNING	APPRENTICES REQUIRED	APPRENTICES PERCENT OF TOTAL MANNING	HELPERS REQUIRED	HELPERS PERCENT OF TOTAL MANNING	TOTAL REQUIRED	TOTAL PERCENT OF TOTAL MANNING
11	SHIPFITTER	7	1.59	29	0.59	25	0.49	13	2.67
26	WELDER	155	3.11	32	0.64	0	—	187	3.74
17	SHEETMETAL	110	2.21	32	0.64	21	0.43	163	3.26
41	BLACKSMITH	2	0.04	1	0.01	1	0.01	4	0.08
41	BOILERMAKER	48	0.96	29	0.59	21	0.43	98	1.96
06	MACHINIST MAINT.	15	0.31	6	0.13	0	—	21	0.42
06	TOOLMAKER	22	0.44	5	0.11	0	—	27	0.54
06	ELECTRICIAN MAINT.	8	0.16	3	0.06	0	—	11	0.22
31	MACHINIST (INSIDE)	170	3.40	23	0.47	11	0.21	204	4.08
38	MACHINIST (OUTSIDE)	203	4.07	28	0.57	21	0.43	252	5.04
56	INSULATOR	35	0.70	18	0.36	0	—	53	1.06
56	PIPEFITTER	195	3.90	35	0.70	14	0.29	244	4.88
81	MOLDER	18	0.37	10	0.19	2	0.04	30	0.60
81	PATTERNMAKER	8	0.16	2	0.04	0	—	10	0.20
51	ELECTRICIAN	20	4.03	32	0.63	14	0.29	247	4.94
67	ELECTRONICS MECH.	164	3.29	23	0.46	0	—	187	3.74
67	FIRE CONTROL "	28	0.56	10	0.21	0	—	38	0.76
64	BOATBUILDER	6	0.11	2	0.03	0	—	8	0.16
64	WOODCRAFTSMAN	42	0.84	10	0.19	4	0.07	56	1.12
64	SHIPWRIGHT	42	0.83	11	0.23	4	0.07	57	1.14
64	MOLDER PLASTIC	7	0.14	2	0.04	0	—	9	0.18
71	PAINTER	107	2.14	10	0.20	14	0.29	131	2.62
71	LETTERER & GRAINR	2	0.03	1	0.01	0	—	3	0.06
72	RIGGER	138	2.76	27	0.54	0	—	165	3.30
72	LABORER	54	1.07	0	—	0	—	54	1.08
99	ELECTRICIAN	22	0.44	5	0.10	0	—	27	0.54
99	PIPEFITTER	30	0.61	4	0.07	0	—	34	0.68
02	AUTO MECHANIC	19	0.39	2	0.04	0	—	21	0.42
02	HEAVY BILE MECH	10	0.19	3	0.06	0	—	13	0.25
02	OILER	11	0.21	0	—	0	—	11	0.22
03	ELECTRICIAN	18	0.36	2	0.04	0	—	20	0.40
03	PIPEFITTER	15	0.29	2	0.04	0	—	17	0.34
07	PLUMBER	16	0.31	2	0.04	0	—	18	0.36
07	ELECTRICIAN	18	0.35	3	0.06	0	—	21	0.42
07	PAINTER	11	0.21	0	—	0	—	11	0.22
07	LABORER	15	0.29	0	—	0	—	15	0.30
		2044	40.89	404	8.07	152	3.04	2600	52.00
	SUPERVISORS								
	PLANNERS, ENGINEERS							2400	48.00
	CLERKS, ADMINISTRATIVE							5000	100.00
	ETC.								

*Table of figures based on data furnished by Mr. James Valentine of the Philadelphia Naval Shipyard. The data has been prorated to adjust for the likely manpower (5000 personnel) for the conceptual shipyard.

Due to the security classification of weapon systems in a military environment, these men should be permanent employees of Iranian nationality. Non-Iranian expertise may be contracted for only for a specified period of time to perform a specific task. Operating a shipyard with large numbers of foreign personnel under contracts would be expensive and an unreliable method.

The story goes that an individual was contracted for the very highly paid job of dockmaster. He was given a few months to familiarize himself with the area, operation system and gather the necessary information needed to develop the docking-schedule. After all that time and expenses for salary, travel and fringe benefits required to hire the man and bring him from overseas to Iran, he disappeared the day before the docking of the first ship!

It is interesting to contrast the task of "<u>personnel and training</u>" with any other major task, such as the physical construction of facilities. It is generally believed that if there is sufficient capital, the construction jobs can be totally contracted (e.g., the men and materials imported) and completed in a specified reasonable time period. But the technical knowledge and expertise required to staff the shipyard can only be acquired through years of training and experience. The importance of this task is quite evident and cannot be over-emphasized. Therefore, in this section the tasks of manpower planning, manpower recruitment and personnel training will be discussed.

1. Manpower Planning Considerations

Every organization, no matter how large or small, uses some sort of system for accomplishing its resource planning. The management of a naval shipyard should always be concerned with having the personnel with the right skills at the right job, at the right time; plus the ability to shift these personnel to achieve maximum manpower utilization. Flexibility is one of the key factors in filling the manpower requirement for this task. The work-scope varies; the number and types of ships assigned changes; unforeseen technical problems occur; new technologies and critical skill demands for new equipment; all require constant management attention if the personnel requirements are to be cost effective and schedules are to be met. Hence, manpower planning and proper forecasting are critical, for the vitality of any large industrial organization. The penalty for failure of planning is reduced effectiveness, inability to perform assigned missions, and a consequent reduction in the operational readiness of the fleet. Therefore, personnel managers and planners/forecasters must consider all sources of internal and external recruitment. Internal recruitment is from sources within the country and external recruitment is from sources outside the country. The number of skilled tradesmen with shipboard experience and technical knowledge from internal sources is very limited. It is even more severe in the case of experienced management, engineers, designers, draftsmen, planners and schedulers, etc. in the field of ship repair and new

construction. The time required to train these personnel, and impart the required experience, is longer than any other task required for the activation of a shipyard. This is because:

a. A majority of the ships and modern weapon systems are imported. The operating instructions, technical manuals and drawings are not in the native language. For proper operation and maintenance of these systems a good working knowledge of the English language is essential.

b. New concepts of modern technology take longer to grasp for those previously unexposed to them. Recruiting a young man from high school; training him for the trade; teaching him technical English as a second language; and providing him the time and exposure necessary to gain the required experience is a long and expensive process. This is not the normal problem of personnel employment in most countries. Because there are, in most European countries sufficient indigenous skilled personnel for initial recruitment, they have to train for only those limited specialized skills that may be needed for a particular job. Further, considering the progress and expansion of the country towards industrialization, it would be appropriate to find out whether there will be enough capable personnel available for future recruitment billets. Hence, other sources of recruitment, such as utilization of more females in defense or importing technicians, must be evaluated. Consideration of recruitment and training of females in the military in most

industrial nations, especially the United States, is growing more important every day.

Importation and employment of foreign technicians for the defense industry have serious drawbacks because:

1) There is no continuity and no assurance that the foreigner will remain to complete his contract. He may quit or leave when there is internal or political disturbance or for any of many other reasons.

2) Foreigners' access to classified equipment and documents may be a cause of problems relative to national security.

3) There is no nationalistic feeling towards the ultimate goals of the nation; the foreigner works primarily for the money. Financial bonuses and personal career objectives are the major and often the only incentives for him.

4) Hiring foreigners is generally less cost-effective in the long-run than training one's own national employees.

5) There is a language barrier and difference in social and cultural norms between the foreigner and the native. The communication barrier is especially aggravated among the tradesmen and can greatly affect their work performance and their personal behavior.

2. Recruitment and Turnover Considerations

There are laws and regulations for recruitment of civilian personnel which are somewhat standard for most

government agencies. The present pay and incentive policies do not guarantee the influx of the personnel required to fill the skilled billets in the military. Recognizing that in most developing countries there is an overall shortage of skilled tradesmen throughout the country, it is natural that the tradesmen who are in high demand will chose larger cities with better community facilities and that they will prefer a more pleasant climate to that of the Persian Gulf.

During the research interviews, the author asked a retired U. S. Navy captain "What are your views on the approach to solving the manning problem for this shipyard? He responded "This is your special problem and I don't have a solution for that!" He further stated that "In the United States, when we need, for example, to employ 100 men, we advertise and probably 1000 people will apply. Then we have to select 100 men from the 1000 applicants." But our case in Iran is different. If we need 100 men, we probably will have to recruit about 300, so that, after a screening process and years of training we may end up with the required 100 trained personnel. These numbers are not an actual indication of turnover rate, but, due to the following factors, the attrition rates tend to be very high, especially in the initial phases of implementation and operation of the new shipyard.

1) There is a shortage of skilled craftsmen and a high demand for trained personnel throughout the rapidly expanding industries within the country.

2) Generally higher compensation and fringe benefits are paid in the commercial industries than by the defense organization.

3) There are special profit-sharing incentives within the commercial firms--Since defense industries are non-profit making organizations, this highly motivating incentive does not apply to defense employees.

4) Remoteness of the location and the special environmental conditions of the Persian Gulf region--The remoteness disturbs close-family ties created by a cultural phenomenon and inconveniences arise due to relocation of families. The Persian Gulf environment is not considered the ideal place for the majority of potential employees. The search for leisure and comfort is a normal behavior for a rational human being. There are more pleasant places, more attrative cities, and more comfort and convenience in other regions of the country.

5) Lack of adequate amenities and recreational facilities (especially in the first few years of operation). People not only require suitable housing to live in, but also there must be adquate medical facilities, educational systems (i.e. kindergarten, schools, universities) and other morale, welfare and recreational support.

6) Defense employment and the military environment may be discouraging to some. The fact that they work for the military implies that they have to work where the Navy sees fit, do what they are told, and conform with the military operating hours, rules and regulations. Further

it appears that there is, presently, a bias against civilian personnel in some defense establishments. There are not yet sufficient career positions, especially in the higher management echelons, for civilians. Merit promotion and other adequate incentive systems must be introduced if there is to be a successful usage and retention of civilians to operate shipyards.

7) Government employment regulations are the toughest barrier for the attraction of skilled men; this is because of lower starting pay and stringent recruitment rules.

8) During initial years of the community buildup in a developing area, shortages, limitations, and higher expenses for basic needs are common. There may be a lack of varieties of food and beverages, clothing, electricity, water, entertainment, etc.

9) Adequate policies and procedures in regards to different skills, position descriptions, promotions, civilian career incentive systems, and fringe benefits, especially appropriate to naval shipyard tasks need be established.

10) The potential work force is largely unfamiliar with shipwork and shipyard working conditions. Unknowns and uncertainties are generally negative incentives to human motivation.

11) The normal attrition due to failure, unsuitability, discharge, drop-out, retirement, desertion, death, etc.

Hopefully, the attrition rates will be reduced over the years as some of these problems are overcome. However, a long-range personnel recruitment and training forecast is essential.

To be able to appreciate the impact of such an attrition rate for a given manpower requirement (as assumed for this program), the author derived the "Manpower Recruitment Model" presented in the next paragraph.

3. Manpower Recruitment Model

This is a model to determine the hiring and training requirements to meet specified goals. The goals here are stated in terms of the number of trained personnel required over successive years in order to have (Y_n) employees at the beginning of any year (n). "Y_n" is the manpower ceiling for the shipyard determined from the assigned workload. Of course, it would require that training be initiated several years prior to the time the shipyard becomes operational. In this example the recruitment and training are assumed to start five years prior to the activation date, with a certain known (assumed) attrition rate. Under the above assumptions, the required additional number of trainees at the beginning of each year (x_n) is related to the goal for the number of employees (y_n) by the equation[31]

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[31]This general static model was derived with the assistance of Professor T. Jayachandran, Department of Mathematics, Naval Postgraduate School, Monterey, California, September 1978.

$$x_n = y_n - \sum_{j=1}^{n-1} \left(\prod_{i=1}^{j} B_i\right) x_{n-j}$$

The second term on the right hand side $\sum_{j=1}^{n-1} \left(\prod_{i=1}^{j} B_i\right) x_{n-j}$ represents the total number lost by attrition over the previous (n-1) years. The product term $\prod_{i=1}^{j} B_i$ occurs because attrition is to be allowed for in a cumulative fashion. Under the model each trainee has an attrition probability B_i for year i.

This general formula could serve as a convenient tool to forecast the long-range manpower requirements. That is, for any given set of attrition rates and planned manpower requirements, the number of personnel to be recruited and trained at the beginning of each successive year will be obtained. Table IV presents this concept of personnel recruitment for the next 27 years of the shipyard program.

a. Description of Manpower Recruitment Chart

The manpower planning for activation and subsequent operation of this shipyard is a continual task throughout its operational life. For this conceptual naval shipyard under consideration, the manpower ceiling and attrition rates are the two given variables. The shipyard will start its initial operation with a skeleton crew of

500 civilian personnel (as stated in Chapter 1 "assumption") at year 5. It will then build up to a complement of about 5000 personnel in a period of nine years with an increment of 500 additional men each year. Thus, the shipyard will reach a steady state in year 14 (9 years of operation) and the manpower ceiling will stay relatively constant at 5000 thereafter.

The attrition rate varies each year because of its changing environment. It is assumed to be at 30% in the first year and reduces to 20, 15, 10 and then eventually 6% for the fifth year of employment for the same group. The varying high attrition rates in the early years of employment are due to the combination of all factors discussed in the previous paragraph. It is assumed, however, to remain constant after the fifth year at a low rate of 6%. These numbers are used for exercise purposes here, selected from a consensus of those who have had working experience in a comparable kind of environment. For example, in this exercise the numbers of new trainees at year 5 is 189 (activation time) while at year 6 it will have to be increased to 602 new entries to meet the demand. At year 14 there should be about 1237 new entries for training. These numbers then gradually decline over the years, when the attrition rate and manpower ceiling are both relatively constant.

START OF OPERATION ↓

TABLE IV MANPOWER RECRUITMENT CHART

BEGINNING OF EACH YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
YEAR OF OPERATION	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	100	70	56	48	43	40	38	36	33	31	30	28	26	25	23	22	20	19	18	17	16	15	14	13	12	12	11
	100	130	91	72	62	56	52	49	46	43	41	38	36	34	32	30	28	26	25	23	22	21	20	19	17	16	15
		200	153	107	86	73	66	62	58	54	51	48	45	42	40	38	35	33	31	29	28	26	24	23	22	20	19
			300	173	120	97	82	74	69	65	61	58	54	51	48	45	42	40	37	35	33	31	29	27	26	24	23
				400	189	132	105	88	79	74	70	66	62	58	55	51	48	45	43	40	38	35	33	31	29	28	26
					500	602	422	336	286	257	242	227	213	201	189	177	167	157	147	138	130	122	115	108	102	96	90
						1000	735	514	412	350	315	296	278	261	246	231	217	204	192	180	170	159	150	141	132	124	117
							1500	838	587	469	399	359	337	317	298	294	281	264	248	234	220	206	194	182	171	161	151
								2000	927	649	519	441	397	373	351	330	310	291	274	258	242	228	214	201	189	178	167
									2500	1003	703	563	478	431	405	380	358	361	316	297	279	262	247	232	218	205	193
										3000	1068	747	598	508	457	430	404	380	357	335	315	296	279	262	246	231	218
											3500	1127	788	631	536	482	453	426	401	377	354	333	313	294	276	260	244
												4000	1183	830	664	565	508	478	449	422	397	373	350	329	310	291	274
													4500	1237	865	692	588	529	498	468	440	413	389	365	343	323	303
														5000	790	552	442	376	338	318	299	281	264	248	233	219	206
															5000	692	472	377	321	289	271	255	240	225	212	199	187
																5000	628	437	350	297	268	252	237	222	209	196	185
																	5000	582	388	310	264	238	223	210	197	186	174
																		5000	551	396	317	269	242	228	214	201	189
																			5000	534	374	300	255	229	215	203	190
																				5000	524	365	292	248	224	210	198
																					5000	517	363	291	247	222	209
																						5000	513	358	287	244	219
																							5000	510	359	287	244
																								5000	509	356	285
																									5000	508	356
																										5000	507
																											5000

Derivation of Formula

Let "X"=No. of recruits each year
(e.g. X_1=100, X_2=130, X_3=153...)

Let "Y"=Manpower ceiling (max no. of personnel each year) (e.g. Y_1=100, Y_2=200, Y_3=300...Y_5=500...Y_{14}=5000, etc.)

Let "A"=Fraction of attrition of the personnel remaining each year (e.g. A_1=.30, A_2=.20, A_3=.15, A_4=.10, A_5=.06, A_6=.06)

Then "B"=(1-A)=Fraction remaining (non-attrited) personnel from previous year (e.g. B_1=.70, B_2=.80, B_3=.85, B_4=.90, B_5=.94, B_6=.96

GENERAL FORMULA

$$X_n = Y_n - \sum_{j=1}^{n-1} \left(\prod_{i=1}^{j} Bi \right) X_{n-j}$$

b. Varying Conditions

Manpower ceiling requirements normally vary with the workload, and the attrition rate changes with the varying environmental conditions. Table IV presented the recruitment forecast for a given attrition rate and manpower ceilings each year. The figures for manpower ceiling are the lowest number shown diagonally across the chart. The figures for personnel recruitments (new entries) are shown directly above the lowest line boxed (shaded). However using the recruitment model, the author made 20 computer programs using different combinations of attrition rates and manpower ceilings. The result is the 25 year recruitment forecast present in Table V; A, through T under columns x_n. It presents the alternative recruitment for different combinations of manpower requirements and attrition rates. These results indicate the magnitude of this training task under variable conditions.

4. Personnel Training

Personnel training and development would consist of all the processes of familiarization, language training, technical training and the individual career development programs. To be able to analyze the task and determine the training requirements, many alternative processes, different skill categories, locations and the methods of training need to be considered.

The training task envisioned for the activation and long range operation of the shipyard can only be successful if there is prior planning, positive communications

Table V Manpower requirements under varying conditions.

A				B				C				D			
n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n
1	0.70	100	100	1	0.65	100	100	1	0.75	100	100	1	0.70	100	100
2	0.80	200	130	2	0.80	200	135	2	0.85	200	125	2	0.85	200	130
3	0.85	300	153	3	0.85	300	160	3	0.90	300	143	3	0.90	300	150
4	0.90	400	173	4	0.90	400	181	4	0.94	400	156	4	0.94	400	164
5	0.94	500	189	5	0.94	500	199	5	0.95	500	166	5	0.95	500	176
6	0.94	1000	602	6	0.95	1000	614	6	0.95	1000	575	6	0.95	1000	586
7	0.94	1500	735	7	0.95	1500	767	7	0.95	1500	683	7	0.95	1500	714
8	0.94	2000	838	8	0.95	2000	880	8	0.95	2000	761	8	0.95	2000	801
9	0.94	2500	927	9	0.95	2500	976	9	0.95	2500	823	9	0.95	2500	869
10	0.94	3000	1003	10	0.95	3000	1058	10	0.95	3000	872	10	0.95	3000	923
11	0.94	3500	1068	11	0.95	3500	1128	11	0.95	3500	914	11	0.95	3500	969
12	0.94	4000	1127	12	0.95	4000	1190	12	0.95	4000	954	12	0.95	4000	1012
13	0.94	4500	1183	13	0.95	4500	1247	13	0.95	4500	992	13	0.95	4500	1053
14	0.94	5000	1237	14	0.95	5000	1301	14	0.95	5000	1029	14	0.95	5000	1093
15	0.94	5000	790	15	0.95	5000	853	15	0.95	5000	566	15	0.95	5000	632
16	0.94	5000	692	16	0.95	5000	728	16	0.95	5000	477	16	0.95	5000	521
17	0.94	5000	628	17	0.95	5000	652	17	0.95	5000	426	17	0.95	5000	463
18	0.94	5000	582	18	0.95	5000	595	18	0.95	5000	395	18	0.95	5000	427
19	0.94	5000	551	19	0.95	5000	554	19	0.95	5000	379	19	0.95	5000	408
20	0.94	5000	534	20	0.95	5000	527	20	0.95	5000	372	20	0.95	5000	398
21	0.94	5000	524	21	0.95	5000	510	21	0.95	5000	368	21	0.95	5000	393
22	0.94	5000	517	22	0.95	5000	499	22	0.95	5000	366	22	0.95	5000	391
23	0.94	5000	513	23	0.95	5000	492	23	0.95	5000	365	23	0.95	5000	389
24	0.94	5000	510	24	0.95	5000	487	24	0.95	5000	364	24	0.95	5000	388
25	0.94	5000	509	25	0.95	5000	483	25	0.95	5000	364	25	0.95	5000	388

Legend: n - Number of years of recruitment

Y_n - Manpower ceiling each year

B_i - Fraction of personnel remaining (non-attrite)

X_n - New entry or trainee each year

Table V Manpower requirements under varying conditions.*

E				F				G				H			
n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n
1	0.65	100	100	1	0.75	100	100	1	0.70	100	100	1	0.70	100	100
2	0.80	250	185	2	0.85	250	175	2	0.85	250	180	2	0.80	250	180
3	0.85	500	328	3	0.90	500	305	3	0.90	500	315	3	0.85	500	318
4	0.90	1000	647	4	0.94	1000	602	4	0.94	1000	619	4	0.90	1000	629
5	0.94	1500	788	5	0.95	1500	699	5	0.95	1500	733	5	0.94	1250	753
6	0.95	2000	896	6	0.95	2000	771	6	0.95	2000	812	6	0.94	2000	852
7	0.95	2500	987	7	0.95	2500	828	7	0.95	2500	874	7	0.94	2500	936
8	0.95	3000	1065	8	0.95	3000	874	8	0.95	3000	926	8	0.94	3000	1008
9	0.95	3500	1132	9	0.95	3500	915	9	0.95	3500	971	9	0.94	3500	1071
10	0.95	4000	1193	10	0.95	4000	954	10	0.95	4000	1013	10	0.94	4000	1129
11	0.95	4500	1249	11	0.95	4500	992	11	0.95	4500	1053	11	0.94	4500	1185
12	0.95	5000	1302	12	0.95	5000	1029	12	0.95	5000	1093	12	0.94	5000	1238
13	0.95	5000	854	13	0.95	5000	566	13	0.95	5000	632	13	0.94	5000	791
14	0.95	5000	729	14	0.95	5000	477	14	0.95	5000	521	14	0.94	5000	692
15	0.95	5000	652	15	0.95	5000	426	15	0.95	5000	463	15	0.94	5000	629
16	0.95	5000	595	16	0.95	5000	395	16	0.95	5000	427	16	0.94	5000	582
17	0.95	5000	554	17	0.95	5000	379	17	0.95	5000	408	17	0.94	5000	551
18	0.95	5000	528	18	0.95	5000	372	18	0.95	5000	398	18	0.94	5000	534
19	0.95	5000	511	19	0.95	5000	368	19	0.95	5000	393	19	0.94	5000	524
20	0.95	5000	499	20	0.95	5000	366	20	0.95	5000	391	20	0.94	5000	517
21	0.95	5000	492	21	0.95	5000	365	21	0.95	5000	389	21	0.94	5000	513
22	0.95	5000	487	22	0.95	5000	364	22	0.95	5000	388	22	0.94	5000	510
23	0.95	5000	483	23	0.95	5000	364	23	0.95	5000	388	23	0.94	5000	509
24	0.95	5000	481	24	0.95	5000	364	24	0.95	5000	388	24	0.94	5000	508
25	0.95	5000	480	25	0.95	5000	364	25	0.95	5000	388	25	0.94	5000	507

*These are the result of 20 varying computer programming (FORTRAN) assisted by CDR M. Sanaie-Fard(Student), Naval Postgraduate School, Monterey, California.

Table V Manpower requirements under varying conditions.

I				J				K				L			
n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n
1	0.75	50	50	1	0.65	50	50	1	0.65	100	100	1	0.75	50	50
2	0.85	100	63	2	0.80	100	68	2	0.80	300	235	2	0.85	100	63
3	0.90	200	121	3	0.85	150	80	3	0.85	500	295	3	0.90	150	71
4	0.94	350	191	4	0.90	200	91	4	0.90	750	392	4	0.94	200	78
5	0.95	750	467	5	0.94	250	100	5	0.94	1250	698	5	0.95	250	83
6	0.95	1250	649	6	0.95	500	307	6	0.95	1750	831	6	0.95	500	288
7	0.95	1750	734	7	0.95	750	384	7	0.95	2250	933	7	0.95	750	342
8	0.95	2250	799	8	0.95	1000	440	8	0.95	2750	1019	8	0.95	1000	381
9	0.95	2750	851	9	0.95	1250	488	9	0.95	3250	1094	9	0.95	1250	411
10	0.95	3250	895	10	0.95	1500	529	10	0.95	3750	1160	10	0.95	1500	436
11	0.95	3750	935	11	0.95	1750	564	11	0.95	4250	1219	11	0.95	1750	457
12	0.95	4250	973	12	0.95	2000	595	12	0.95	4750	1274	12	0.95	2000	477
13	0.95	4750	1011	13	0.95	2250	623	13	0.95	5000	1077	13	0.95	2250	496
14	0.95	5000	798	14	0.95	2500	650	14	0.95	5000	791	14	0.95	2500	515
15	0.95	5000	522	15	0.95	2750	676	15	0.95	5000	690	15	0.95	2750	533
16	0.95	5000	452	16	0.95	3000	702	16	0.95	5000	623	16	0.95	3000	551
17	0.95	5000	411	17	0.95	3250	726	17	0.95	5000	574	17	0.95	3250	569
18	0.95	5000	387	18	0.95	3500	751	18	0.95	5000	541	18	0.95	3500	588
19	0.95	5000	376	19	0.95	3750	775	19	0.95	5000	519	19	0.95	3750	606
20	0.95	5000	370	20	0.95	4000	799	20	0.95	5000	505	20	0.95	4000	624
21	0.95	5000	367	21	0.95	4250	823	21	0.95	5000	495	21	0.95	4250	642
22	0.95	5000	365	22	0.95	4500	847	22	0.95	5000	489	22	0.95	4500	660
23	0.95	5000	365	23	0.95	4750	871	23	0.95	5000	485	23	0.95	4750	679
24	0.95	5000	364	24	0.95	5000	895	24	0.95	5000	482	24	0.95	5000	697
25	0.95	5000	364	25	0.95	5000	669	25	0.95	5000	480	25	0.95	5000	465

Legend: n - Number of years of recruitment

Y_n - Manpower ceiling each year

B_i - Fraction of personnel remaining (non-attrite)

X_n - New entry or trainee each year

Table V Manpower requirements under varying conditions.

M				N				O				P			
n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n
1	0.75	100	100	1	0.70	50	50	1	0.70	100	100	1	0.70	50	50
2	0.85	300	225	2	0.80	100	65	2	0.80	300	230	2	0.80	100	65
3	0.90	500	268	3	0.85	200	127	3	0.85	500	283	3	0.85	150	77
4	0.94	750	349	4	0.90	350	201	4	0.90	750	376	4	0.90	200	86
5	0.95	1250	635	5	0.94	750	486	5	0.94	1250	676	5	0.94	250	94
6	0.95	1750	725	6	0.94	1250	689	6	0.94	1750	793	6	0.94	500	301
7	0.95	2250	793	7	0.94	1750	801	7	0.94	2250	886	7	0.94	750	367
8	0.95	2750	848	8	0.94	2250	893	8	0.94	2750	967	8	0.94	1000	419
9	0.95	3250	893	9	0.94	2750	972	9	0.94	3250	1037	9	0.94	1250	464
10	0.95	3750	934	10	0.94	3259	1039	10	0.94	3750	1098	10	0.94	1500	502
11	0.95	4250	973	11	0.94	3750	1100	11	0.94	4250	1156	11	0.94	1750	534
12	0.95	4750	1010	12	0.94	4250	1157	12	0.94	4750	1211	12	0.94	2000	564
13	0.95	5000	797	13	0.94	4750	1211	13	0.94	5000	1014	13	0.94	2250	592
14	0.95	5000	522	14	0.94	5000	1014	14	0.94	5000	741	14	0.94	2500	619
15	0.95	5000	452	15	0.94	5000	741	15	0.94	5000	660	15	0.94	2750	645
16	0.95	5000	411	16	0.94	5000	660	16	0.94	5000	605	16	0.94	3000	671
17	0.95	5000	387	17	0.94	5000	605	17	0.94	5000	567	17	0.94	3250	697
18	0.95	5000	376	18	0.94	5000	567	18	0.94	5000	543	18	0.94	3500	722
19	0.95	5000	370	19	0.94	5000	543	19	0.94	5000	529	19	0.94	3750	748
20	0.95	5000	367	20	0.94	5000	529	20	0.94	5000	520	20	0.94	4000	773
21	0.95	5000	365	21	0.94	5000	520	21	0.94	5000	515	21	0.94	4250	798
22	0.95	5000	365	22	0.94	5000	515	22	0.94	5000	512	22	0.94	4500	824
23	0.95	5000	364	23	0.94	5000	512	23	0.94	5000	510	23	0.94	4750	849
24	0.95	5000	364	24	0.94	5000	510	24	0.94	5000	508	24	0.94	5000	875
25	0.95	5000	364	25	0.94	5000	508	25	0.94	5000	508	25	0.94	5000	650

Legend: n - Number of years of recruitment

Y_n - Manpower ceiling each year

B_i - Fraction of personnel remaining (non-attrite)

X_n - New entry or trainee each year

Table V Manpower requirements under varying conditions.

Q				R				S				T			
n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n	n	B_i	Y_n	X_n
1	0.70	50	50	1	0.70	100	100	1	0.70	50	50	1	0.65	50	50
2	0.85	100	65	2	0.85	300	230	2	0.85	100	65	2	0.80	100	68
3	0.90	150	75	3	0.90	500	280	3	0.90	200	125	3	0.85	200	130
4	0.94	200	82	4	0.94	750	364	4	0.94	350	197	4	0.90	350	208
5	0.95	250	88	5	0.95	1250	655	5	0.95	750	478	5	0.94	750	497
6	0.95	500	293	6	0.95	1750	761	6	0.95	1250	675	6	0.95	1250	715
7	0.95	750	357	7	0.95	2250	836	7	0.95	1750	771	7	0.95	1750	840
8	0.95	1000	400	8	0.95	2750	896	8	0.95	2250	843	8	0.95	2250	940
9	0.95	1250	434	9	0.95	3250	946	9	0.95	2750	900	9	0.95	2750	1025
10	0.95	1500	461	10	0.95	3750	991	10	0.95	3250	948	10	0.95	3250	1098
11	0.95	1750	485	11	0.95	4250	1033	11	0.95	3750	992	11	0.95	3750	1162
12	0.95	2000	506	12	0.95	4750	1073	12	0.95	4250	1033	12	0.95	4250	1221
13	0.95	2250	526	13	0.95	5000	863	13	0.95	4750	1073	13	0.95	4750	1276
14	0.95	2500	546	14	0.95	5000	577	14	0.95	5000	863	14	0.95	5000	1078
15	0.95	2750	566	15	0.95	5000	492	15	0.95	5000	577	15	0.95	5000	791
16	0.95	3000	586	16	0.95	5000	445	16	0.95	5000	492	16	0.95	5000	690
17	0.95	3250	605	17	0.95	5000	417	17	0.95	5000	445	17	0.95	5000	623
18	0.95	3500	625	18	0.95	5000	403	18	0.95	5000	417	18	0.95	5000	574
19	0.95	3750	644	19	0.95	5000	396	19	0.95	5000	403	19	0.95	5000	541
20	0.95	4000	663	20	0.95	5000	392	20	0.95	5000	396	20	0.95	5000	519
21	0.95	4250	683	21	0.95	5000	390	21	0.95	5000	392	21	0.95	5000	505
22	0.95	4500	702	22	0.95	5000	389	22	0.95	5000	390	22	0.95	5000	495
23	0.95	4750	722	23	0.95	5000	388	23	0.95	5000	389	23	0.95	5000	489
24	0.95	5000	741	24	0.95	5000	388	24	0.95	5000	388	24	0.95	5000	485
25	0.95	5000	510	25	0.95	5000	388	25	0.95	5000	388	25	0.95	5000	482

Legend: n - Number of years of recruitment

Y_n - Manpower ceiling each year

B_i - Fraction of personnel remaining (non-attrite)

X_n - New entry or trainee each year

and proper coordination between all parties concerned. Considering the importance of this task, the time constraint, and the magnitude of the problem, a comprehensive program must be initiated immediately. In fact, when the author asked the question "When should a training program be started to meet the objectives?", the answer from those better acquainted with this kind of undertaking was "two years ago"! One training path will not serve the entire shipyard work force. Many alternative processes (paths) and various combinations of programs will be required.

Personnel generally will enter the work force with varying degrees of training and experience. Each must be evaluated and placed in the most appropriate position in order to maintain an economy of manpower, money and time; and at the same time meet the objective. Training for this program should be accomplished in three distinct phases: Preactivation, initial operation, and full manning and long range operations.

a. Pre-activation

This is the period assumed to be 5 years prior to start up, where the 500 men skeleton crew has to be recruited and trained. Note from Table IV that 745 (100 + 130 + 153 + 173 + 189 = 745) persons were recruited to obtain 500 in year 5. It is appropriate that this training task be a gradual build up in an increment of personnel each year. It is evident from Table IV that at the start of operations (i.e., the beginning of year 5) out of the 500 men "on board" only

a fraction (about 1/4) of the total will have completed their training. (The remaining will still be in apprentice training schools.)

The factors that should be considered prior to the start of the training program are:

- The identification, evaluation, and preparation of key personnel who must be involved during the pre-activation phase (e.g., the Navy's training department, training centers; education, ministry and contractors, etc.). The program office is responsible for the planning, scheduling, coordination and control of the overall task, while the actual training will have to be performed by the Navy's training centers/commands and education ministry.
- A detailed analysis of each operational and maintenance position must be developed and used as a guide for the design and development of a training program.
- The selection of the most appropriate training paths for each job position must be made in order to provide effective instruction for the attainment of total job competency. For example while it may be desirable to send some officers, designers and engineers overseas for technical or management training, it is more appropriate to train apprentice mechanics, and journeymen in the home country. The differences in life-style and habits between European and Middle-Eastern countries may cause too much disruption and preclude the individual from learning his trade.

- The preparation of courses of study, course materials, and evaluation instruments that will result in qualified operational or maintenance personnel.
- A detailed training plan to meet the objectives of each phase.
- The development of a Central Training Center that is sufficiently equipped to provide for the training staff, administration, classrooms, training aids and work shops needed for startup and follow-on training programs.

(1) TRAINING PLAN CONSIDERATIONS

A comprehensive training plan must consider a number of variables brought about by the demands of this program. An abbreviated list would include:

- Equipment operation and maintenance manuals, trouble-shooting manuals, training manuals, training aids, and technical representatives capable of instructing these, should be provided by the equipment vendors.
- The utilization of senior military ratings with shipboard experience to provide expertise for and supervision of facility personnel performing work on ships while in port for repairs, thereby augmenting the on-the-job training.
- The importance of safety will require the implementation of safety training for all levels of the work force.
- The acquisition and development of a training staff capable of training at all levels to meet the needs

of the job. These instructors may have to be initially recruited from overseas to train the native instructors. Another alternative is to send qualified Iranian technicians overseas for instructor training courses.

- The ability to revise existing instructional material for use in the training of personnel of varied intellectual levels and ethnic backgrounds to meet the qualifications required for acceptance into the work force.
- The development and implementation of a testing and evaluation system for on-the-job trainees to ensure that each trainee receives the variety of experiences required for competency in the job.
- The impact that the implementation of stringent security procedures will have on the training programs.

All departments supporting the training program need to give full attention to the fact that the capability for efficient operation of the shipyard must exist at a specified time. Development of training plans will need the solid operational support resulting only from dedicated commitment. Each step of the apprentice training program must be structured with appropriate experiences and provisions for follow-up training to meet the needs of the job.

(2) TRAINING ASSUMPTIONS

Training programs will be needed at several levels. In order to train approximately 500 personnel to

perform work at several levels of competency, exercise complex duties, within specific time constraints, training must include classroom and work shop experience as well as supervised on-the-job training. The success of a comprehensive plan can occur if the following assumptions are met:

- The training departments of the navy (Director of Personnel) and command concerned must be committed to a development program of continuing education training.
- Shop supervisors support and assist in the accomplishment of on-the-job training programs.
- Instructors must be experts in their job.
- Initial on-the-job training must be established at other operational shipyards or repair facilities in positions with like work requirements.
- The specific jobs within each category must be analyzed to minimize training requirements and only job related step by step instruction be developed for each job.
- During recruitment and screening of personnel, willingness to work and learn must be given consideration in cases where education and experience are lower than desired for entry to training.

b. Initial Operational Phase

This is the period when the shipyard will start its limited operation with approximately 500 employees.

For example, the acceptance for employment in certain positions will require that those being considered be university, junior college, high school, or vocational school graduates. However, personnel must be trained and developed for the tasks and skills required. It is rightfully stated: "Leaders are made and not born" [11]. Those applicants that fall short of the educational requirements but are considered to be trainable can be recommended to the training centers for the appropriate training.

To facilitate the implementation of the work force, a percentage of each major category of personnel already must be proficient in their work assignments and not require immediate training to do the job for which they are hired. Such personnel also will be required to provide expertise to assist curriculum development and instruction for those in like job categories.

The shipyard personnel may be divided into four probable categories as below: See Table VI.

(1) PROFESSIONAL AND MANAGERIAL PERSONNEL

Personnel within this category are concerned with the theoretical and practical aspects of science, engineering, management, education and business systems and their operation, administration, design and planning. They may constitute about 15% (75) of the total personnel at this stage. It is essential that this category be college graduates with a working knowledge of their profession. Those accepted to the facility

TABLE VI: NAVAL SHIPYARD INITIAL OPERATIONAL PHASE *

INPUT LEVELS REQUIRED	PRIOR EXP.	CATEGORY DISCIPLINES AND SUB ELEMENTS	TRAIN TIME (MIN.)	NUMBERS & % OF TOTAL WORK FORCE
College Degree	20%	Fully Qualified with Shipyard Experience		
		PROFESSIONAL & MANAGERIAL		15%
	80%	Planners Designers Engineers Managers	4 yrs.	75
Jr. College Prof. Schools High School Voc-Tech.	25%	Fully Qualified with Shipyard Experience		
		TECHNICIAN PERSONNEL		30%
	75%	Electrician Testing Electronics Mechanics Safety Weapon Specialists	3 yrs.	150
6-9 Grade Mechanical Aptitude Testing	25%	Fully Qualified with Shipyard Experience		
		CRAFTS		35%
	75%	Structurals Fitters Machinist Sheet Metal Welders Piping	2 yrs.	175
8-12 years of High School	25%	Fully Qualified with Shipyard Experience		
		CLERICAL & SERVICE		20%
	75%	Administrative Warehouse Utilities Timekeepers Helpers Fire Record Clerks Maintenancemen Security	1 yr.	100
Civilian Input	100%	ALL		100%
Navy Input			4 yrs.	500

Numbers and percentages are composition estimates and are not derived from any manpower charts.

*Based on ideas provided by Mr. Thomas Stolle, Assistant Manager, International Training, Brown & Root, Inc., Houston, Texas, Oct. 1978

that lack the experience commensurate with their responsibility should be provided the opportunity to undergo an orientation period at the facility with like functions in order to attain the experience required. A minimum of 20 percent of the personnel within this category must be totally qualified and have prior shipyard experience in their job functions for startup. The remainder should train at other naval shipyards or ship repair facilities preferably in country or at a foreign navy or civilian shipyard to gain their experience. This experience can be acquired through observations, work situations, and seminars on subjects pertinent to their job classification.

(2) TECHNICIAN PERSONNEL

Personnel in this category are concerned with trouble shooting, removal, repair, installation, quality assurance, and testing of all ships components that are functionally mechanical, electrical, electronic, or weapon specialists. The electrical, mechanical, electronic and weapon specialists and testing technicians required for startup will amount to approximately 30 percent of the work force. Twenty-five percent, as a minimum, of this group must be fully qualified and experienced in their jobs. These qualified personnel will provide the facility as well as the training center with their knowledge and experience, as experts in their field. Their services as instructors and

subject matter experts (SME) will expedite the upgrading of the remainder of the startup personnel in this category. The knowledge and theory required to function within this category will require that those considered by junior college, technical/professional schools, high schools with professional experience, or vocational school graduates. Passing of an aptitude test will not suffice for acceptance to this category.

(3) CRAFTS PERSONNEL

This category will include structural, fabrication and other shop personnel that are required to machine, fabricate, erect or install machinery, structural parts, ship hulls, and superstructures. Those personnel required to perform these functions will include machinist, welders, riggers and fitters. They will comprise 35 percent of the startup work force.

Personnel applying for this category must be capable of passing a mechanical aptitude test for acceptance to the work force or to training (sixth to ninth grade education or equivalent). The possibility that some of the craftsmen required may be drawn from the construction work force is highly improbable. The upgrading of construction spin offs in this category can be accomplished in the time frame allocated prior to startup. All entry level workers claiming certified experience should be tested with appropriate tests designed to evaluate both performance skills and theoretical knowledge.

If qualified, the worker will be placed in a position commensurate with his experience. If found underqualified, but trainable, he will be enrolled in a training program designed to qualify him for the work force.

(4) CLERICAL AND SERVICES PERSONNEL

The administrative and maintenance personnel required for startup will total approximately 20 percent of the work force of 500. The clerical workers will be concerned with preparing, transcribing, transferring and systemizing records, collecting amounts, and distributing information.

The services personnel are the facility housekeeping workers such as firemen, utility maintenancemen, transportation personnel, and packaging and warehousemen. Personnel selected for these positions should pass a mechanical or clerical aptitude test prior to acceptance. Personnel with a qualifying aptitude test will enter the work force if they possess sufficient experience to meet the job needs. Those with insufficient knowledge and experience, but with adequate aptitude, will attend training classes.

(5) OTHER CONSIDERATIONS

Minimum entry level skills for each position will have been determined by qualified supervisors or job specialists. An analysis of each job will include what the

person does on that job and what training or skill he needs to have to perform the job.

(a) AVAILABILITY OF ON-SITE EXPERTISE

Phasing through the initial operational phase will occur over about a nine year period after startup. The availability of highly qualified personnel and on-site instructors, developed during this phase, will provide a capability of all in-house training. Contractor and vendor services should be utilized to the maximum extent possible for all ongoing services to include instructors, manuals, and local schools, if available.

(b) REFINEMENT OF TRAINING APPROACHES

Training during the startup period will require the implementation of training programs that may have appeared adequate at the time. During the training from initial operation to full manning, all levels of instruction will be continuously refined to increase the training efficiency and capacity in order to meet the ceiling goal of 5000.

(c) INCREASED CAPACITY OF THE TRAINING CENTER

The increase in manpower requirements will place greater demands on the training itself. The availability of completed training centers and instructors with more experience, acquired during this phase, should increase the training productivity.

(d) MAGNITUDE OF TRAINING

The training effort required to prepare 4500 additional trained personnel in four categories, will require providing a training system that will handle a maximum input 12 times the size of the first year's input. The impact of this magnitude of training must be reduced by increasing the activity and productivity to achieve the demand output.

A solution to a greater training output would be to enlarge the instructor staff, ensure that adequate classroom space is available, and provide a schedule for trainee input to meet manpower scheduling as well as refining the training paths necessary to acquire job knowledge.

c. Full Manning and Long-Range Operation

This is the period of approximately nine years after the activation of the shipyard (year 14). From this time forward the shipyard workload, and consequently the work force, is projected to be steady and constant at approximately 5000 personnel. The buildup of manpower requirements during

the first few years of operation will provide the training centers with more accurate statistics on the turnover rate created by attrition, progression and development. The manpower-recruitment model presented in paragraph 3 can be a very useful and powerful tool to use for future manpower requirements forecasting. Utilizing the model (with the revised figures) and with the aid of a computer, the training manager can automatically develop a schedule for classes that will be necessary to train enough personnel to assure full manning.

(1) CROSS-TRAINING--A CONSIDERATION

The sudden loss of an employee from a highly critical position within the work force can create a work slowdown or even work shutdown. Experience has proven that maintaining personnel proficient in several positions within a classification, through cross-training, will provide desired flexibility and a source of filling a void until someone can be trained to assume the vacant position (created by illness, dealth, or attrition). Therefore, a program for continuing education, cross training, and career broadening must be developed for used during the latter operation and full manning phase.

5. Other Training Considerations

Other training sources outside the Department of the Navy should be considered, their capabilities utilized and

coordinated in order to help reduce the Navy's training burden. These other sources are:

a. Defense Training Centers

Other defense technical training establishments such as Air Force for aircraft and gas turbine technician training, and the Army schools for similar weapon systems or other skills courses.

b. Government Agencies Training Facilities

For example the Education Ministry can increase its entry quota in the technical/professional schools and the Labor Ministry may provide additional mobile technical training facilities. The Mobile vans can be utilized to provide instructors and equipment for on-site-training of craftsmen.

c. National and Commercial Training Facilities

For example, the National Iranian Oil Company has years of experience in training engineers and technicians in their Technical College and apprentice training school. Also maximum use of other commercial contractors and industrial facilities should be made.

d. Other Nation Contractors

Foreign contractors and suppliers who have the training capability should be used, as appropriate. The program manager and contracting officer should be in a good bargaining position prior to the signing of a contract for construction, equipment or other services to require from

the contractors and vendors an agreement to teach the skills in which they are specialized and which are needed for the operation of the shipyard.

e. Other Shipyards

U. S. Naval shipyards perform apprentice training programs. Such programs are normally four years in duration for all trades. Based on discussions with some of the training managers, this training period can be reduced to one, two or three years for some of the structural (rigging, welders and painting) and mechanical, and electrical trades. The new employees are normally high school graduates. During the training period, the trainees spend about one day per week in the class-room and the other four days in the shop/field working with the supervisors or qualified mechanics, receiving on-the-job training and experience.

The author asked the commander of a U. S. Naval shipyard what his views were on training craftsmen from allied countries in the shipyard apprentice training center. He stated that he would not welcome such a job. His task is the repair and maintenance of the fleet and not "training". A shipyard is not manned to act as a training facility for personnel except for the apprentice training required for in-house purposes. Nevertheless defense and commercial shipyards overseas with "<u>training willingness</u>" and capabilities can provide effective training for both professional and managerial levels in order to gain further experience on new systems and modern technology.

f. Overseas Training Centers and Universities

Specialized training institutions in the industrial countries may be used to the extent required. Due to the language requirements, and also cultural and social differences, western training instutions are most useful to those professional and managerial personnel having the necessary background and language proficiency.

g. Doing the Job One is Trained to Do

It is not uncommon to see a man trained in a specialized field assigned to another job which is completely alien to his expertise. We have all seen a professional engineer doing a marginal job teaching, or an experienced technician pushing papers in a central office. Such practices are an ineffective use of talent and often do not serve the organizational objectives. Misutilization of resources is as damaging to the individual as to the organization. The right man in the right job is a sound basis for an efficient operation.

h. In-House Expertise

Often a department or an organization goes through tremendous troubles and expense to get an "<u>expert</u>" from a far distant horizon. Such an expert in a particular technical field is most often alien to the local environmental, cultural, and political situation. If one looked closely in country there probably is a well qualified and more suitable individual or institution available. A system needs to be developed and utilized to assist management to search and retrieve more accurate information in

order to make a better decision on the availability and recruitment of key personnel, from in country assets. It is important to have all the alternatives available and when the experts are in-house (in-country) "consult them", "believe them" and "use them". In-house expertise can often be more reliable, responsible and accountable.

i. Language Difficulty

The language barrier can create a horrendous problem, both for the individuals and the organizations. Modern ships and related systems are acquired mostly from various western industrial nations. The operating manuals, technical instructions, and drawings are thus in other languages and cause additional problems in training, learning processes and interaction of individuals. English is the most common second language and the preferred technical language in Iran. Most personnel in managerial positions, but only a few in the tradesman level, have the ability to communicate in English. Multi language requirements (English, French, German, Farsi) further complicate the problem. The story goes that in an industrial facility an English speaking training firm originally was contracted for craftsmen training. With the very limited English language capabilities of the trainees, the team just managed to operate an O.J.T.[41] program with the help of sign language. Although the objective (training) was lost along the way, the company carried out a fine service in many other fields as directed. When the profit oriented

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[41] O.J.T. stands for on-the-job training.

contractor started employing third country nationals (from Korea, Philippines, etc.) because it was cheaper for the company, the training program was a failure. The trainers were fine technicians, but their inability to communicate with their counterpart made it ineffective. Hence, common language, even on a limited basis, should be a requirement with inter-cultural training tasks. As a first step the training program can be facilitated by qualified native trainers developed in country or overseas.

Those issues presented in this section are some of the major considerations to be given to the vitally important task of training. There is no way that one could completely cover the total personnel and training program in this section. However, it is evident that training is the single most critical task for activation of a shipyard. The manpower recruitment model has been formatted in such a way to exclude the many variable factors (i.e., patriotism, trained personnel being hired off the economy; funds available for better incentive and pay; stable and improved environmental conditions, etc.). If any of these conditions change for the better, they will improve the attrition rate and thus reduce the yearly input requirements. Any gains in this area have been looked at as a free bonus or a backup for contingencies. However, if the recruitment and training program is to succeed, innovation in attracting manpower, both military and civilian, to the geographic location under consideration is essential. New educational technology should provide faster and better means of training. Modern

facilities can provide better habitability and more comfortable living and working conditions in the Persian Gulf area.

Strong patriotism, loyalty and individual dedication can help to provide the motivation required for those involved in this very challenging task. Through personal experience, the author contends that there are sufficiently large numbers of dedicated Iranians, willing to sacrifice their personal comfort and convenience for the good of their country in such a worthwhile endeavor. Such dedication and sense of duty will undoubtedly be necessary to make this program a feasible undertaking.

VII. CONCLUSION

A. SUMMARY

The concepts of "planning for activation" in this thesis could be applied to any large-scale program where there exist acute constraints on resources, geographical remoteness, and unique environmental conditions. The challenge of the Persian Gulf area has resulted in unprecedented special requirements for long-range planning and for integrated logistic support. It must be emphasized here that these considerations apply to a conceptual shipyard and should not be looked at as necessarily rigid requirements, or to refer to any particular government agency or Navy organization. In fact, they are intended to comprise <u>just</u> a conceptual presentation; i.e., an attempt to discuss some of the more important issues and considerations related to an activation program.

The "activation" or "start up" of a conceptual shipyard is the time when the coordinated efforts of many organizations/agencies, contractors, suppliers, and individuals have merged, their many multifaceted <u>individual</u> project objectives towards the one collective common goal of the organization. The amalgamation of masses of men and materials, and the proper mixes and effective utilization of these resources is the only assurance of the eventual smooth operation of a naval shipyard. The operational readiness

of the fleet, which is the ultimate purpose of the organization, can only be guaranteed by the effective support from its shipyard(s).

Understanding the environment of a naval shipyard is absolutely essential to the attainment of this goal. A naval shipyard is a tremendous industrial asset, of irresplaceable value to the fleet. Its specific capabilities should be tailored to meet the needs of a changing mix of ship types that make up today's modern fleet. Allowance also must be provided for future expansion, modernization, and technological developments necessary to meet the needs of the fleet of the future. The work force in a naval shipyard should contain a mix of varried skills and experience sufficient for the maintenance of the complex shipboard weapon systems, so essential to a modern navy. There must be programs to recruit, train, and retain a work force, to insure constant availability and stability of trained personnel. The work force should also be kept current and cross-trained in the ever changing technology, in order to meet the maintenance requirements of the fleet.

The physical and social environment of the area under consideration will greatly affect the activation process as well as the subsequent operation of a naval shipyard. For any large-scale industrial activity such as a shipyard, the proper choice or organizational structure becomes an important question; consequently, managing the inevitable bureaucracy requires careful considerations.

There are many advantages to the bureaucratic organization of a naval shipyard; but its limitation must also be considered. In the best of its form, bureaucracy can only serve those who establish and maintain the system, and not necessarily any other organizations. Recognizing the cultural differences and the social norms of different societies, there should exist a normalization period for the bureaucratic process to grow to maturity.

Several functions are crucial to the success of any large-scale program. These are: planning; scheduling; organization and staffing; and control. Furthermore, the proper understanding and preparation for logistics support for a military project as complex as a naval shipyard is absolutely essential.

Planning must play an integral part in any activity or organization. Regardless of the capital outlay, the number of employees, or the time span, the principles required for a successful planning effort remain the same. The need for planning is evident due to the increasing time span of projects, the complexity of large organizations, the dynamic nature of modern technology, and ever-increasing specialization. The proper approach to planning is never the same from one project to the next or, for that matter, among different departments and agencies. An approach must be developed specifically for the problem at hand, based on the nature of the projects, the time frame, and the multiplicity of options. Long-range planning will look

the distant future as far as trends can be predicted, requiring strong, top-level support (because of the existance of uncertainties) and the dedication to major commitments and decisions that have to be made. Uncertainties involved in long-range planning should be considered so that the plan may be modified to meet the new requirements. Even the best plans can be rendered useless by failure to consider all facets of the problem and the unforeseen changes or realities involving a large-scale project; e.g., the unique environmental conditions and remote location of the Persian Gulf coastal area exert a special impact on the most sophisticated and well-laid plans. Planning should not be left to the professional planner or a core planning team. All too often what results is the planning team's "plan", and not the organization's. It is imperative that the managers (who will be responsible for the plan's implementation) be actively involved in the planning. Planning should be a dynamic, group effort. "Brain-storming" and similar managerial techniques work equally well for coordinated planning. Poor coordination upsets many plans in a complex and multi-faceted project. Proper coordination of activities is the only sure way of achieving a common goal. The key factors contributing to better coordination is a clear understanding of the problem, and effective communication.

Another equally important factor leading to the successful completion and subsequent operation of any project of this type is the proper logistics support. It is essential that the analysis of logistics support for a major program be performed from the program's inception. Logistics has been defined as "the art and science of management, engineering, and technical activities, concerned with requirements, design, and supply, and maintaining resources to support objectives, plans, and operations" [24:52]. To improve the management of limited resources, one should look at "the big picture" aspect of Integrated Logistic Support (I.L.S.).

The elements of I.L.S. are: personnel and training, supply support, facilities, transportation and handling, test and support equipment, technical data, and maintenance planning. The object of I.L.S. is to assure that effective logistic support is planned, acquired, and managed as an integrated whole.

With regards to a naval shipyard, I.L.S. may be defined as a management function providing the initial planning, funding and controls. This in turn assures that the navy and ships of the fleet will have a maintenance support activity that will not only meet performance requirements, but one which also can be effectively supported throughout its life-cycle. The system life-cycle may be said to start from the perception of a need and terminate with disposal of the system. The five phases of the system life-cycle

are: (1) concept formulation and system definition; (2) development; (3) production and installation; (4) operation and support; (5) modification and retirement.

The proper integration of the various elements of logistics and coordination between various organizational entities responsible for logistics is the key factor responsible for the success of this program. In specifically considering the shipyard under study here, it is well recognized that some of the support elements may be outside the scope of the Navy's authority, and shall be performed by other government agencies. For example, the electrical and water supply services would be provided by the Energy Ministry; the construction of roads and railways is the responsibility of the Road and Transportation Ministry; all forms of communication (post, telephone, telex, and telegraph) are under the authority of the Communication (P.T.T.) Ministry; and the training of the labor force could be a joint responsibility with the Navy, the Labor and the Education Ministries.

These support services are not only essential to the construction of the naval shipyard and associated facilities, but are equally important to the future operation of both the shipyard and support activities.

Planning, scheduling, coordination, and control are "the names of the game", and are absolutely critical for the success of the shipyard activation program. The concept of project management can be very helpful in achieving

the desired objectives of such a complex undertaking. The emphasis here is on planning and decision-making within the context of a specific project, i.e., "shipyard activation program". Managing such a program requires an organized and dynamic management approach that can coordinate activities within the total program. Here the need for a unifying agent becomes apparent, i.e., the "program manager". He is that individual who is appointed to accomplish the task of integrating functional and extra-organizational efforts and direct them toward the successful performance of a specific program. Organization and staffing of the program office is critical. While recognizing that there is no perfect or single <u>best</u> organizational structure for all programs, there are advantages and disadvantages to each of many approaches, whether <u>functional</u>, <u>project</u>, or <u>matrix</u>. The important factor is the recognition and awareness of the strengths and weaknesses of each, in order that the one which is best suited to the particular environment may be utilized.

Program management relies heavily on the efforts of a staff to monitor and control the many functions. The number and kind of staff required for the program office will depend on the nature of the program itself. The quality of the staff assigned to the program is more important than the number of personnel. They must be experienced in the field, well qualified technically, and must have desirable personality traits also. For such a major

development program, progress towards the deadlines and cost targets requires advanced scheduling techniques. Scheduling is the specification of dates and times and interdependencies for performing functions and implementing the many subplans of the projects.

Project control is a process by which managers assure that resources are obtained and utilized effectively for the accomplishment of the program's objectives. The control of the project's performance is the critical measure of success or failure for the activation program.

The Use of various managerial tools can be helpful for the scheduling and control process. PERT and CPM networks are a few of the management tools for scheduling and controlling projects. They provide management with a clear definition of time, cost and resource requirements. They are operational networks that relate all activities in a time dimension and pinpoint critical activities. PERT and CPM are powerful tools and have been developed to aid the decision maker's intuition and judgement, but the final decision must rely on on the manager's subjective evaluations.

The program manager must take an active role in the management of the project, constantly correlating time/cost with schedule and budget. Effective information processing

for managerial decision-making is vital to the organization's success.

A Management Information System (MIS) must be developed to furnish the right information, to the right person, at the right time, both for the activation program and the shipyard operation.

B. RECOMMENDATIONS

The following recommendations are submitted:

1. Establish a program office consisting of a high ranking program manager with a program office staff of qualified individuals. A multi-matrix organizational structure and an authority-responsibility relationship for this program office were developed and presented in Figures 15 and 16, Chapter VI, Section B. The potential for conflict will exist in a matrix organization. But with the clear definition of accountability and responsibilities of individuals (Figure 16), ambiguity can be clarified and conflicts managed.

The major tasks for activation of the naval shipyard under study were identified in Chapter VI as: (1) personnel and training; (2) construction of facilities; (3) test equipment and supply support; (4) utility support; (5) roads and railroads; (6) transportation and handling; (7) general communication; and (8) shipyard operational requirements. While all of the above tasks are crucial, the task of recruitment and training the large numbers of personnel

required to operate a shipyard in the Persian Gulf environment will prove to be the most challenging one. This leads to the next recommendation.

2. Personnel recruitment and training should be seriously considered and a program should be started without delay. If this appears to be too monumental a task, we must rely on Allah!

Source: [5:149]

Appendix A: U. S. NAVY SHIPYARDS

Name and Location	Building Positions			Drydocks				Depth of Water		Total Employees **
	No.	L.O.A.	Width	Type and (No.)	Length	Clear Width	Lifting Capacity (Long Tons)	Yard	Channel	
Charleston (Charleston, S.C.)	3	600	90	GD (5) FD (2)	750 492	140 59	 3,500			7,231
Long Beach (Long Beach, Ca.)				GD (3) FD (2)	1,092 400	144 66	 4,000			7,320
Mare Island (Vallejo, Ca.)	2	680	105	GD (4) FD (2)	740 492	92 59	 3,500			10,658
Norfolk (Portsmouth, Va.)	9	910	120	GD (7)	1,092	143		40	40	10,422
Pearl Harbor (Honolulu, Hawaii)				GD (4)	1,088					5,413
Philadelphia (Philadelphia, Pa.)				GD (5)	1,093	143				10,963
Portsmouth (Portsmouth, N.H.)	4	435	55	GD (3)	741	91		35	40	7,638
Puget Sound (Bremerton, Wash.)				GD (6)	1,152	158		53	45	9,872

Notes: FD (Floating); GD (Graving); BD (Building). All dimensions are shown in feet. Clear width column, under "Drydocks" refers to width at keel blocks. Number in parenthesis under "Drydocks" in the "Type & No." column indicates the total number of that particular type of drycock that is/are available in that yard. All dimensions and lifting capabilities listed are those belonging to the largest building positions/drydocks in that particular yard.

**Denotes total employees (civilian and military) as of March 1970.

Appendix B: Organizational Relationships

Chart 1: An organization chart showing the relationship of the Secretary of the Navy to the Chief of Naval Operations, Chief of Naval Material, Naval Sea Systems Command, and the Shipyard Commander.

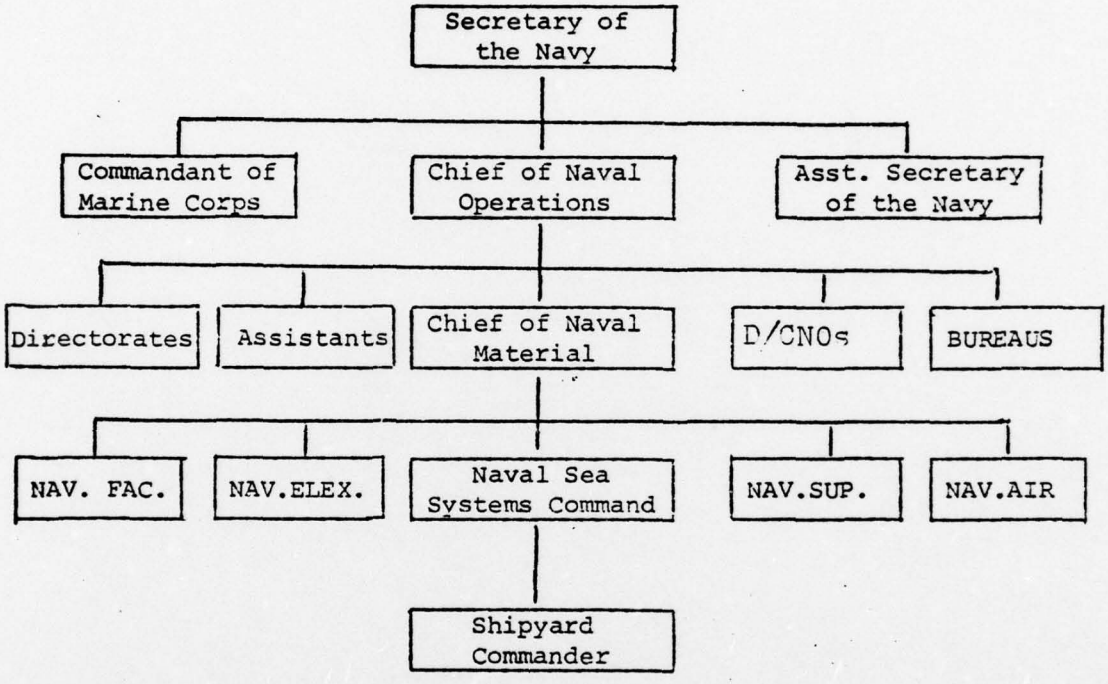
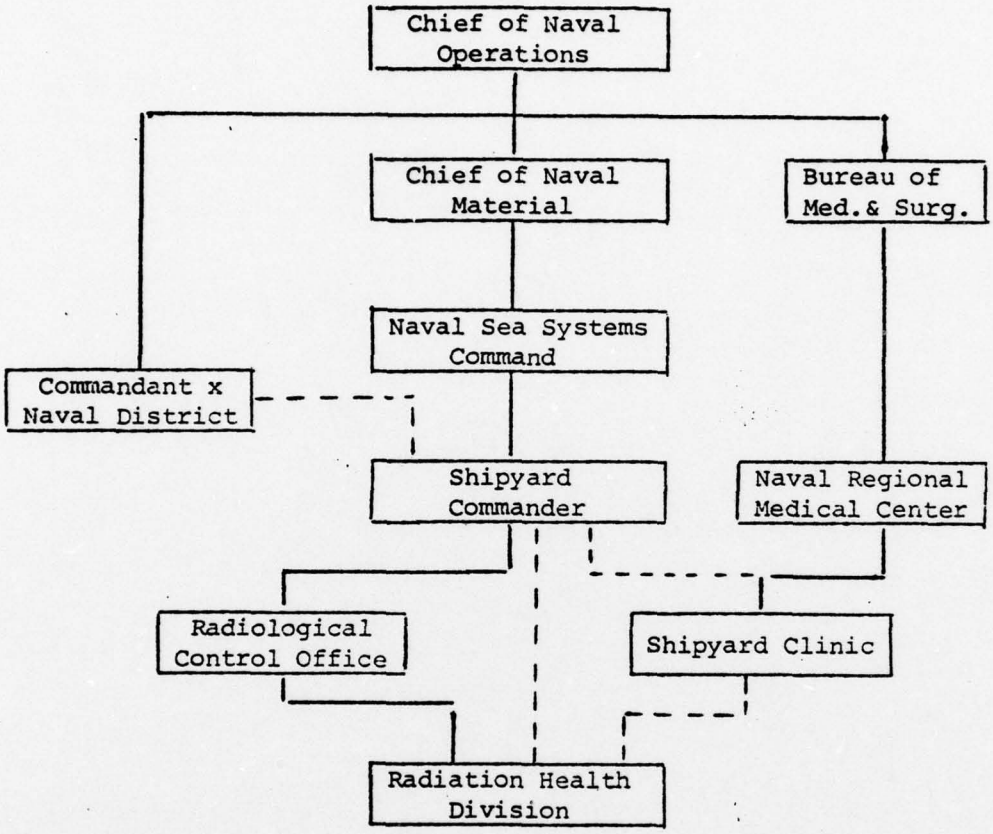


Chart 2: An organization chart showing the relationship between the Shipyard Commander, Commandant(x) Naval District and Naval Regional Medical Center.



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